U.S. Environmental Protection Agency Region 7

East Fork Medicine Creek
Sullivan and Putnam Counties, Missouri

Total Maximum Daily Load

October, 2006

Approved by:

/s/ 11/22/2006

William A. Spratlin **Date**
Director
Water, Wetlands and Pesticides Division

Total Maximum Daily Load (TMDL)
East Fork Medicine Creek
Pollutant: Sediment

Name: East Fork Medicine Creek

Downstream Location: Grundy County

Hydrologic Unit Code (HUC): 10280103

Water Body Identification (WBID): 619

Missouri Stream Class: The impaired segment of East Fork Medicine Creek is a Class P Stream[1].

Beneficial Uses[2]:

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life
- Human Health Protection (Fish Consumption)
- Whole Body Contact Recreation - Category B

Size of Impaired Segment: 36 miles

Location of Impaired Segment[3]: From 9, 61N, 22W to the State Line (refer to Table H 10 CSR 20-7)

Pollutant: Sediment

Pollutant Source: Agricultural Nonpoint Source

TMDL Priority Ranking: Low

1. Introduction

This East Fork Medicine Creek Total Maximum Daily Load (TMDL) for sediment is being established in accordance with Section 303(d) of the Clean Water Act, because the State of Missouri determined on the 1998 and 2002 303(d) lists of impaired waters that the water quality standards (WQS) for East Fork Medicine Creek were exceeded due to sediment. To meet the milestones of the 2001 Consent Decree, *American Canoe Association, et al. v. EPA*, No. 98-1195-CV-W in consolidation with No. 98-4282-CV-W, February 27, 2001, EPA is establishing this TMDL.

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[1] Class P streams maintain permanent flow during drought conditions, see 10 CSR 20-7.031(1)(F).
[2] For Beneficial Uses see 10 CSR 20-7.031(1)(C) and Table H.
[3] See Table H 10 CSR 20-7.

The purpose of a TMDL is to determine the pollutant loading a waterbody can assimilate without exceeding the WQS for that pollutant. The TMDL also establishes the pollutant load allocation necessary to meet the WQS established for each waterbody based on the relationship between pollutant sources and in-stream water quality conditions. The TMDL consists of a wasteload allocation (WLA), a load allocation (LA), and margin of safety (MOS). The WLA is the fraction of the total pollutant load apportioned to point sources. The LA is the fraction of the total pollutant load apportioned to nonpoint sources. The MOS is a percentage of the TMDL that accounts for the uncertainty associated with the model assumption and data inadequacies.

2. Background and Water Quality Problems

East Fork Medicine Creek originates in Iowa and flows into Missouri northwest of Powersville, in Putnam County. The creek flows through Putnam, Sullivan, and Grundy Counties for 36 miles before it joins with West Fork Medicine Creek, south of Galt, Missouri, to form Medicine Creek in Grundy County. The associated watershed is approximately 235 square miles. East Fork Medicine Creek is considered a permanently flowing class "P" stream. The primary cause of the sediment impairment to East Fork Medicine Creek has been identified as pollution caused by agricultural nonpoint sources.

All waters of the State, as per Missouri WQS, must provide suitable conditions for aquatic life. The conditions include both the physical habitat and the quality of the water. TMDLs are not written to address habitat, but are written to correct water quality conditions. Because the waterbody addressed by this TMDL was assessed as to its biological function, many factors may have contributed to the impairment. The State of Missouri continues to do field evaluation and in the future, may define the role sediment is playing in the potential biological impairment of this waterbody. However, the water quality condition for which East Fork Medicine Creek is currently listed is sedimentation; therefore, this TMDL addresses sediment. The State of Missouri may submit and EPA may approve another TMDL or a modified 303(d) listing for this water at a later time to address new information on the impairment.

A combination of natural geology and land use (Table 1 and Figure 1) in the prairie portions of the state is believed to have reduced the amount and impaired the quality of habitat for aquatic life. The major problems are excessive rates of sediment deposition due to stream bank erosion and sheet erosion from agricultural lands, loss of stream length and loss of stream channel heterogeneity due to channelization, and changes in basin hydrology that have increased flood flows and prolonged low flow conditions. Loss of tree cover in riparian zones has caused elevated water temperatures in summer and a reduction in woody debris, a critical aquatic habitat component in prairie streams. The most compelling evidence of loss or impairment of aquatic habitat is the change in the historical distribution of fishes in Missouri. Many species of fish no longer appear in portions of the state where they once lived[4].

[4] Missouri Department of Natural Resources, 2005. Total Maximum Daily Load (TMDL) Information Sheet for Streams with Aquatic Habitat Loss that are Listed for Sediment, http://www.dnr.mo.gov/env/wpp/tmdl/info/habitat-info.pdf.

East Fork Medicine Creek was placed on the Missouri 303(d) list for sedimentation. This was primarily based on best professional judgment as little sediment data exists to directly document sediment impacts to the stream. General fisheries data and the effect of sediment on fish were the initial data used to consider East Fork Medicine Creek for 303(d) listing. For this TMDL, sediment targets were derived using generalized information from the ecological drainage unit (EDU).

Since the 303(d) listing, Missouri Department of Natural Resources (MDNR) has developed a sediment protocol to determine if sediment is actually the pollutant in the streams listed and to arrive at a standard way to measure sediment. The first step of that protocol is a biological assessment to see if the biological community is actually impaired. In the case of East Fork Medicine Creek, this assessment measured habitat quality, water quality, and macroinvertebrate (like larval mayflies and crayfish) communities.[5] Upper East Fork Medicine Creek was sampled September 2003 and April 2004. Lower East Fork Medicine Creek was sampled September 2004 and March 2005. Eleven stations were assessed in the 36-mile impaired segment. The final report is in Appendix F[6]

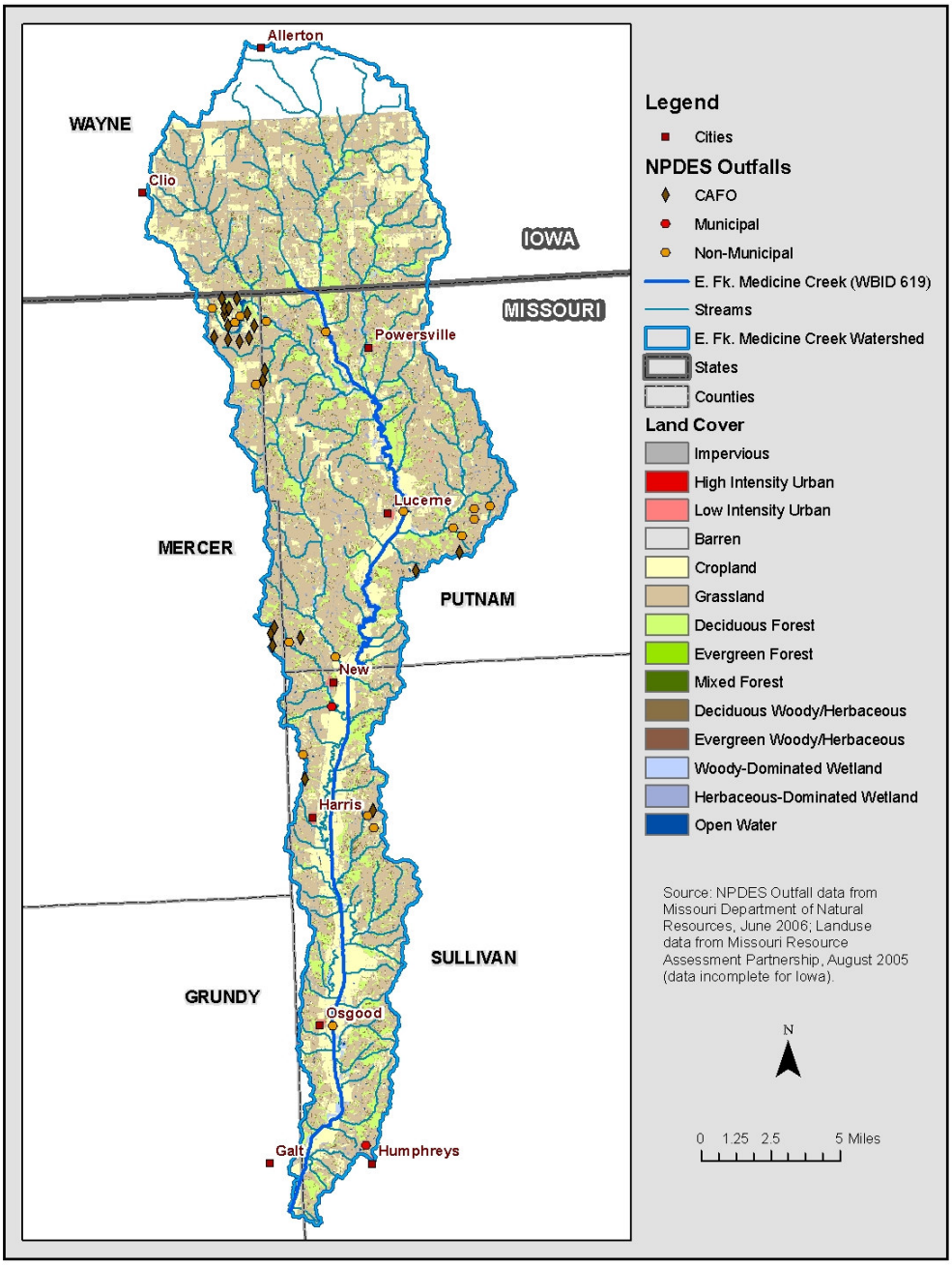
Table 1: Land Use Distribution for East Fork Medicine Creek

Type	**Percent%**
Grassland	57.2
Cropland	20.1
Deciduous Forest	12.2
Ddeciduous Woody/Herbaceous	3.6
Woody-Dominated Wetland	2.5
Impervious	2.4
Herbaceous-Dominated Wetland	0.9
Open Water	0.7
Low Intensity Urban	0.2
Barren	0.1
Evergreen Forest	<0.1
High Intensity Urban	<0.1
Mixed Forest	<0.1
Evergreen Woody/Herbaceous	<0.1
Watershed Area= 235 mi²	

[5] Biological Assessment and Habitat Study, East Fork Medicine Creek, Sullivan and Putnam Counties, 2003-2005, Missouri Department of Natural Resources

[6] Missouri Department of Natural Resources, 2006. Biological Assessment and Habitat Study, Little East Fork Medicine Creek, Grundy and Putnam Counties, 2003-2005.

Figure 1 – East Fork Medicine Creek Map



3. Description of Sources

3.1 Point Sources

There are two National Pollution Discharge Eliminations system (NPDES) waste water treatment facilities (WWTF) (Table 2) in the East Fork Medicine Creek watershed. The City of Newton and the City of Humphreys each have one municipal WWTF that discharges treated effluent into East Fork Medicine Creek.

Six, Concentrated Animal Feeding Operations (CAFO) are registered, certified or permitted within the watershed. CAFOs are animal feeding operations in which animals are confined to areas that are totally roofed. CAFOs typically utilize earthen or concrete structures to contain and store manure prior to land application. All permitted livestock facilities have waste management systems designed to minimize runoff entering their operations or detaining runoff emanating from their areas. Such systems are designed for a 25-year, 24-hour rainfall/runoff event. NPDES permits are issued for facilities with more than 1,000 animal units (AU). Total permitted AUs for all facilities is approximately 126,096 AU. The actual number of AUs on site is variable, but typically less than potential numbers.

Table 2: Permitted Facilities

Facility - CAFOs	Permit number	County	Design Flow
James Rhodes	MO-G010034	Mercer	Non discharging
PSF, Overlook Ranch	MO-G010037	Sullivan	Non discharging
PSF, Badger/Wolf/Brantley (outfall #6 and #17)	MO-0118745	Mercer	Non discharging
PSF, Badger/Wolf/Brantley (outfall #8 and #21)	MO-0118745	Putnam	Non discharging
PSF - Terre Haute	MO-0118761	Putnam	Non discharging
PSF, Locust Ridge Finish (outfall #003, 13,19,and 14)	MO-0118494	Sullivan	Non discharging
PSF-Somerset Farm (outfall #22)	MO-0118168	Mercer	Non discharging
Facility – Other			
Newton WWTF	MO-0117871	Sullivan	0.0258 MGD
Humphreys WWTF	MO-0119750	Sullivan	0.013 MGD

3.2 NonPoint Sources

Most of the watershed is grassland (57%), deciduous forest (12%), or cropland (20%). Much of the impaired segment is near or adjacent to cropland. Cropland that is adjacent to and drains into East Fork Medicine Creek could contribute to the sediment impairment. Livestock in the watershed include many horses, cattle, and hogs held in pastures and feedlots in addition to the NPDES-permitted CAFOs in the watershed (Tables 3 and 4).

Table 3 – Livestock Estimates per County[7]

	Mercer	Sullivan	Putnam	Grundy
Cattle	**Animal Units**	**Animal Units**	**Animal Units**	**Animal Units**
Beef	15,206	29,203	20,647	10,644
Milk	62	276	451	927
Cow/Calf	27,412	38,409	52,930	20,462
Hogs/Pigs	(D)	(D)	(D)	13,250
Sheep/Lambs	559	660	485	2,038
Poultry				
Layers	866	3	737	1,019
Broilers	(D)	(D)	150	(D)

(D) Withheld to avoid disclosing data for individual farms.

Table 4: Livestock Estimates per Iowa County[8]

	Wayne
Cattle	
Beef	20,725
Milk	928
Cow/Calf	41,929
Hogs/Pigs	9,770
Sheep/Lambs	636
Poultry	
Layers	427
Broilers	(D)

(D) Withheld to avoid disclosing data for individual farms.

Overland runoff can easily carry sediment from agricultural land into the stream. Soil from exposed land runs into the creek, increasing the turbidity and concentration of total suspended solids (TSS) and decreasing the transparency. Background levels of TSS come from natural fluvial processes. Sediment becomes suspended during high flow events as soil along the banks is eroded and bed sediment is re-suspended. Sediment loading in East Fork Medicine Creek comes predominantly from nonpoint source pollution.

4. Description of the Applicable WQS and Water Quality Targets

4.1 Beneficial Uses

East Fork Medicine Creek has the following beneficial uses:

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life

[7] USDA- NASS Quick Stats (Livestock) 2002 Census of Agriculture, Volume 1 Chapter 2: Missouri County Level Data http://www.nass.usda.gov/census/census02/volume1/mo/st29_2_001_001.pdf

[8] USDA- NASS Quick Stats (Livestock) 2002 Census of Agriculture, Volume 1 Chapter 2: Iowa County Level Data http://www.nass.usda.gov/census/census02/volume1/ia/IAVolume104.pdf

- Human Health Protection (Fish Consumption)
- Whole Body Contact Recreation - Category B

The stream classifications and designated uses may be found at 10 CSR20-7.031(1)(C) and (F) and Table H.

Use that is impaired

- Protection of Warm Water Aquatic Life

4.2 Antidegradation Policy

Missouri's WQS include the EPA "three-tiered" approach to antidegradation, and may be found at 10 CSR 20-7.031(2).

Tier 1 – Protects existing uses and provides the absolute floor of water quality for all waters of the United States. Existing in-stream water uses are those uses that were attained on or after November 29, 1975, the date of EPA's first WQS Regulation, or uses for which existing water quality is suitable unless prevented by physical problems such as substrate or flow.

Tier 2 – Protects the level of water quality necessary to support the propagation of fish, shellfish, and wildlife and recreation in and on the water in waters that are currently of higher quality than required to support these uses. Before water quality in Tier 2 caters can be lowered, there must be an anti-degradation review consisting of: (1) a finding that it is necessary to accommodate important economical or social development in the area where the waters are located; (2) full satisfaction of all intergovernmental coordination and public participation provisions; and (3) assurance that the highest statutory and regulatory requirements for point sources and best management practices (BMPs) for nonpoint sources are achieved. Furthermore, water quality may not be lowered to less than the level necessary to fully protect the "fishable/swimmable" uses and other existing uses.

Tier 3 – Protects the quality of outstanding national resources, such as waters of national and state parks, wildlife refuges and waters of exceptional recreational or ecological significance. There may be no new or increased discharges to these waters and no new or increased discharges to tributaries of these waters that would result in lower water quality (with the exception of some limited activities that result in temporary and short-term changes in water quality).

4.3 Narrative Criteria

The impairment of this waterbody is based on exceedence of the general, or narrative, criteria contained in Missouri's WQS, 10 CSR 20-7.031(3)(A), (C) and (G).

(A) Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses;

(C) Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses;

(G) Waters shall be free from physical, chemical or hydrologic changes that would impair the natural biological community.

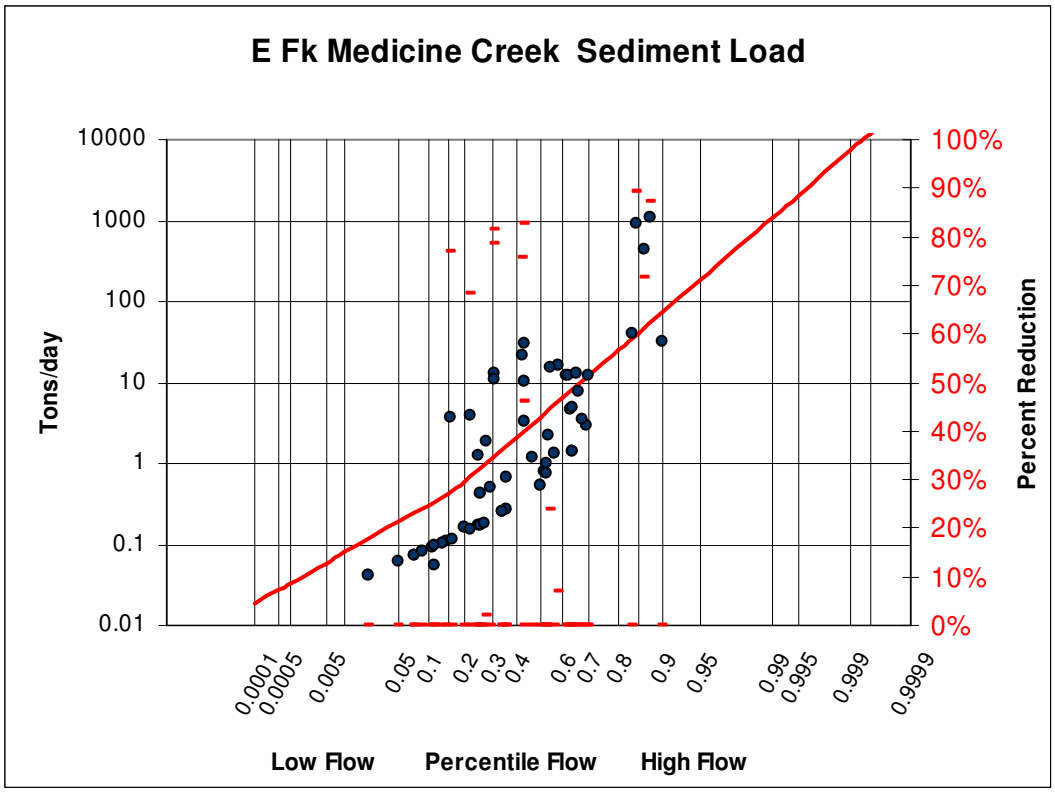
When the WQS is expressed as a narrative value, a measurable indicator of the pollutant may be selected to express the narrative as a numeric value. There are many quantitative indicators of sediment, such as, TSS, turbidity, and bedload sediment, which are appropriate to describe sediment in rivers and streams.[9] TSS was selected as the numeric target for this TMDL because it enables the use of the highest quality data available, including permit conditions and monitoring data.

5. Calculation of Load Capacity

Load capacity (LC) is defined as the maximum pollutant load that a waterbody can assimilate and still attain WQS. This total load is then divided among a WLA for point sources, a LA for nonpoint sources and a MOS. The LC for this TMDL has been defined as a curve over the range of flows for East Fork Medicine Creek; see Figure 2, where the solid (red) curve is the TMDL. The TMDL targets up to an 89% reduction in sediment load over the range of flows as seen in Figure 2. Measurements are shown in Figure 2, where round (black) points are loads calculated form TSS concentrations in East Fork Medicine Creek and any corresponding horizontal bars (red) are the percent reduction required to meet the TMDL. Turbidity measurements taken during the biological assessment were used to estimate TSS concentrations using relationships developed by Doisey and Rabeni.[10] These estimates along with measured TSS data are shown in Figure 2.

[9] Framework for Developing Suspended and Bedded Sediments (SABS) Water Quality Criteria, U.S. Environmental Protection Agency, EPA-822-R-06-001, May 2006.
[10] Effects of Suspended Sediment on Native Missouri Fishes: A Literature Review and Synthesis, K.E. Doisey and C.F. Rabeni, 2004, University of Missouri.

Figure 2. TMDL Allocation and Percentage of Reduction for East Fork Medicine Creek.



5.1 Modeling Approach

For case of East Fork Medicine Creek, where narrative standards are targeted for the impaired stream, a reference approach is used. In this approach, the target for pollutant loading is the 25th percentile of the current EDU condition calculated from all data available within the EDU in which the waterbody is located. Therefore, the 25th percentile is targeted as the TMDL load duration curve (LDC). For a full description of the development of suspended sediment targets using reference LDC refer to Appendix E. Specific data sources for this TMDL and EDU-wide TSS data are listed in Appendix F. Table 5 shows estimates of discharge at flow percentiles. The biological assessment showed that lower East Fork Medicine Creek is supporting the aquatic life use and upper East Fork Medicine Creek is partially supporting the aquatic life use.

Table 5: Estimated Flow for Range of Percentiles at the Impaired Segment Outlet

	Percent of Flow	Discharge (cubic feet per second)
Flow estimate for East Fork Medicine River based on	10	6.37
	30	18.3

drainage area and synthetic ecological drainage unit flow.	50	39.2
	70	86.5
	90	289

6. Waste Load Allocation (Point Source Loads)

WLA is the allowable amount of the pollutant that can be assigned to point sources. The WLA is set to the lesser of current permit limits or technology based effluent limits (TBELs). TBELs are defined in a permit based on facility type. Mechanical WWTFs' permit limits are a weekly average TSS concentration of 45 mg/L and a monthly average TSS concentration of 30 mg/L. Secondary equivalent WWTFs' permit limits are a weekly average TSS concentration of 60 mg/L and a monthly average TSS concentration of 45 mg/L. Waste water treatment lagoon facilities' permit limits are up to a weekly average TSS concentration of 120 mg/L and a monthly average TSS concentration of 80 mg/L. Additionally, permits can be written to target lower limits if the specific facility is capable of performance exceeding TBELs. Table 6 lists the permitted point sources in the watershed and WLAs based on their current permit limits and permitted design flows. In addition any general permits need further evaluation to determine if a site specific permit is needed to address sediment loading. Based on the assessment of sources, point sources do not contribute to water quality impairment relative to sediment impacts on stream biology. Thus, the WLAs are zero percentage net reduction in sediment load. These facilities' WLAs are set at the current permit limits and conditions. The WLAs listed in this TMDL do not preclude the establishment of future point sources of sediment loading in the watershed. Any future point sources should be evaluated in light of the TMDL established and the range of flows into which any additional load will impact.

Table 6: Waste Load Allocations for point sources of sediment in East Fork Medicine Creek watershed.

Facility	NPDES Permit	WLA (tons/day) d/w/m*
Facility - CAFO		
James Rhodes	MO-G010034	0/0/0
PSF, Overlook Ranch	MO-G010037	0/0/0
PSF, Badger/Wolf/Brantley (outfall #6, 8, 17, 21)	MO-0118745	0/0/0
PSF - Terre Haute	MO-0118761	0/0/0
PSF, Locust Ridge Finish (outfall #003, 13,19,and 14)	MO-0118494	0/0/0
PSF-Somerset Farm (outfall #22)	MO-0118168	0/0/0
Facility – Other		
Newton WWTF (outfall 01)	MO-0117871	NA/0.018/0.007
Humphreys WWTF (outfall 01)	MO-0119750	NA/0.006/0.004

*Permit limits based on current design loads where d=daily, w=weekly average, m=monthly average.

All permitted livestock facilities (CAFOs) are non-discharging permits. The WLAs are set at zero (Tables 2 and 6).

Stormwater runoff from all permitted facilities also discharges to the stream. Compliance with the Missouri Storm Water Permit will ensure construction sites meet the TMDL area weighted loadings. The SWPPP ensures the design, implementation, and maintenance of BMPs. EPA assumes that construction activities in the watershed will be conducted in compliance with Missouri's Storm Water Permit including monitoring and discharge limitations. Compliance with this permit should lead to sediment loadings from the construction site at or below applicable targets.

7. Load Allocation (Nonpoint Source Loads)

LA is the allowable amount of the pollutant that can be assigned to nonpoint sources. The LA is set at 90% of the TMDL shown in Figure 2. Based on measured data from the creek, the percentage of reduction in sediment load ranges to 89% over the range of flows.

8. Margin of Safety

A MOS is usually added to a TMDL to account for the uncertainties inherent in the calculations and data gathering. The MOS is intended to account for such uncertainties in a conservative manner. Based on EPA guidance, the MOS can be achieved through one of two approaches:

(1) Explicit – Reserve a numeric portion of the LC as a separate term in the TMDL.
(2) Implicit – Incorporate the MOS as part of the critical conditions for the WLA and the LA calculations by making conservative assumptions in the analysis.

Available data for East Fork Medicine Creek shows instances where load exceeds the TMDL (Figure 2). To account for uncertainties in the modeling an explicit 10% MOS is assigned to this TMDL. For example, at 0.5 (median flow) the TMDL is 3.8 tons/day and the MOS would be 0.38 tons/day.

9. Seasonal Variation

The TMDL curve represents flow under all seasonal conditions. The LA and TMDL are applicable at all flow conditions, hence all seasons. The advantage of LDC approach is to avoid the constraints associated with using a single-flow critical condition during the development of a TMDL. Therefore, all flow conditions including seasonal variation are taken into account for TMDL calculations.

In addition bioassessment data used in this TMDL was generated in two seasons. Invertebrate sampling was collected for two seasons: Fall (September 2003 for Upper East Fork Medicine Creek, September 2004 for Lower East Fork Medicine Creek) and spring (April 2004 for Upper East Fork Medicine Creek, March/April 2005for Lower

East Fork Medicine Creek). Invertebrate's sampling scores of 16 or greater are judged to indicate unimpaired streams and scores less than 16 are judged to be impaired. The samples were collected at 6 sites in lower East Fork Medicine Creek for both fall 2004 and spring 2005, as shown in the Table 7. The samples were collected at 5 sites in East Fork Medicine Creek for fall 2003 and spring 2004, as shown in the Table 8.

Table 7. Lower East Fork Medicine Creek Invertebrate Data

Aquatic Invertebrate Scores		
Location	**Fall 2004**	**Spring 2005**
Site 1	20	20
Site 2	20	18
Site 3	20	20
Site 4	20	20
Site 5	20	14
Site 6	20	20

Table 8. Upper East Fork Medicine Creek Invertebrate Data

Aquatic Invertebrate Scores		
Location	**Fall 2003**	**Spring 2004**
Site 1	20	18
Site 2	18	16
Site 3	14	16
Site 4	12	18
Site 5	20	20

Note: An MSCI score of 16-20 is considered full biological sustainability, 10-14 is partial biological sustainability, and 4-8 is non-biological sustainability. Invertebrate scores of 16 or greater are judged to indicate unimpaired streams. Scores less than 16 are judged to be impaired.

10. Monitoring Plans for East Fork Medicine Creek

MDNR conducted bioassessments on upper and lower East Fork Medicine Creek in 2003-2005, as well as gathering chemistry data from 2003-2005. No future monitoring has been scheduled for East Fork Medicine Creek at this time. However, the department will routinely examine physical habitat, water quality, invertebrate community, and fish community data collected by the Missouri Department of Conservation under its Resource Assessment and Monitoring (RAM) Program. This program randomly samples streams across Missouri on a five to six year rotating schedule.

11. Public Participation

EPA regulations require that TMDLs be subject to public review (40 CFR 130.7). EPA is providing public notice of this TMDL for East Fork Medicine Creek on the EPA,

Region 7, TMDL website: http://www.epa.gov/region07/water/tmdl_public_notice.htm. The response to comments and final TMDL will be available at: http://www.epa.gov/region07/water/apprtmdl.htm#Missouri.

This water quality limited segment of East Fork Medicine Creek in Sullivan, Grundy, Mercer and Putnam Counties, Missouri, is included on the EPA approved 1998 and 2002 303(d) lists for Missouri. This TMDL is being produced by EPA to meet the requirements of the 2001 Consent Decree, *American Canoe Association, et al. v. EPA*, No. 98-1195-CV-W in consolidation with No. 98-4282-CV-W, February 27, 2001. EPA is developing this TMDL in cooperation with the State of Missouri, and EPA is establishing this TMDL at this time to fulfill the *American Canoe* consent decree obligations. Missouri may submit and EPA may approve another TMDL for this water at a later time.

As part of the public notice process, MDNR assists EPA by providing a distribution list of interested persons to which EPA will provide an announcement of East Fork Medicine Creek TMDL. Groups that receive the public notice announcement include the Missouri Clean Water Commission, the Missouri Water Quality Coordinating Committee, Stream Team Volunteers in the county, county legislators, and potentially impacted cities, towns and facilities. The EPA public noticed this TMDL from October 6, 2006, to November 5, 2006, and the Summary of response to Comment(s) is posted on the EPA website: http://www.epa.gov/region07/water/apprtmdl.htm#Missouri.

12. References

Biological Assessment and Habitat Study, Lower East Fork Medicine Creek, Sullivan and Putnam Counties, 2003-2005. Department of Natural Resources, Environmental Services Program

K.E. Doisey and C.F. Rabeni, 2004, Effects of Suspended Sediment on Native Missouri Fishes: A Literature Review and Synthesis, University of Missouri.

Missouri Department of Natural Resources, 2005, Total Maximum Daily Load (TMDL) Information Sheet for Streams with Aquatic Habitat Loss that are Listed for Sediment, http://www.dnr.mo.gov/env/wpp/tmdl/info/habitat-info.pdf.

Missouri Department of Natural Resources, 2007, Quality Assurance Project Plan for Wasteload Allocations/Special Studies.

USDA, 2002, NASS Quick Stats (Livestock) Census of Agriculture, Volume 1 Chapter 2: Missouri County Level Data http://www.nass.usda.gov/census/census02/volume1/mo/st29_2_001_001.pdf.

USDA- NASS Quick Stats (Livestock) 2002 Census of Agriculture, Volume 1 Chapter 2: Iowa County Level Data http://www.nass.usda.gov/census/census02/volume1/ia/IAVolume104.pdf

USEPA, 2006, Development of Suspended Sediment Targets using Reference Load Duration Curves, EPA Region 7, Kansas City, KS.

USEPA, May 2006, Framework for Developing Suspended and Bedded Sediments (SABS) Water Quality Criteria, EPA-822-R-06-001.

Chariton River Basin – 10280201, 10280202, Department of Natural Resources, Water Protection Program, Water Quality Monitoring and Assessment Section, Watershed Information Sheet. http://www.dnr.mo.gov/env/wpp/watersheds/info/10280201-2.pdf

13. Appendices

Appendix A _West Fork Medicine Creek and East Fork Medicine in Plains/Grand/Chariton EDU
Appendix B – Map of East Fork Medicine Creek, impaired segment (upper) and sampling sites.
Appendix C – Map of East Fork Medicine Creek, impaired segment (lower) and sampling sites.
Appendix D: Data for East Fork Medicine Creek
Appendix E: Development of Suspended Sediment Targets using Reference Load Duration Curves
Appendix F – Biological Assessment and Habitat Study, East Fork Medicine Creek, Sullivan and Putnam Counties, 2003-2005

Appendix A:

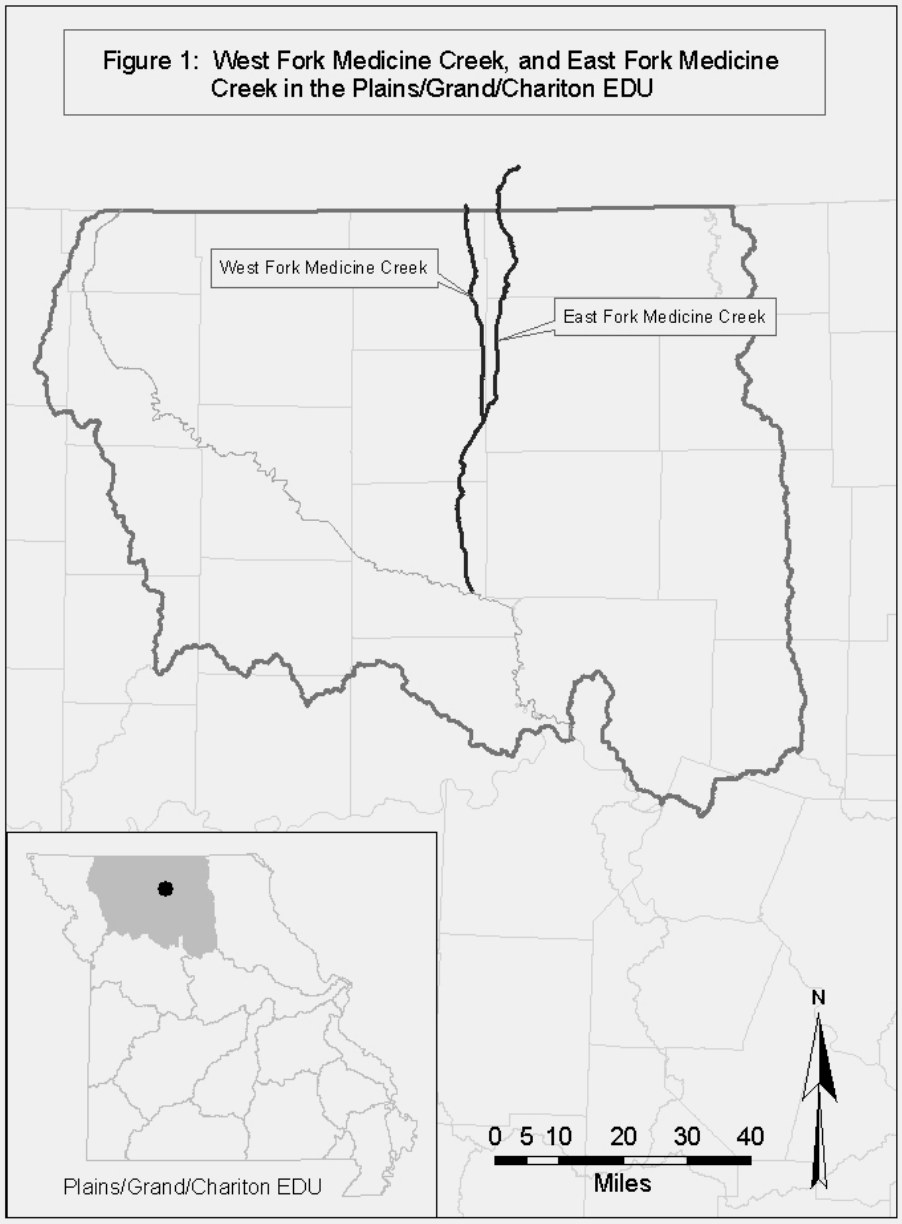
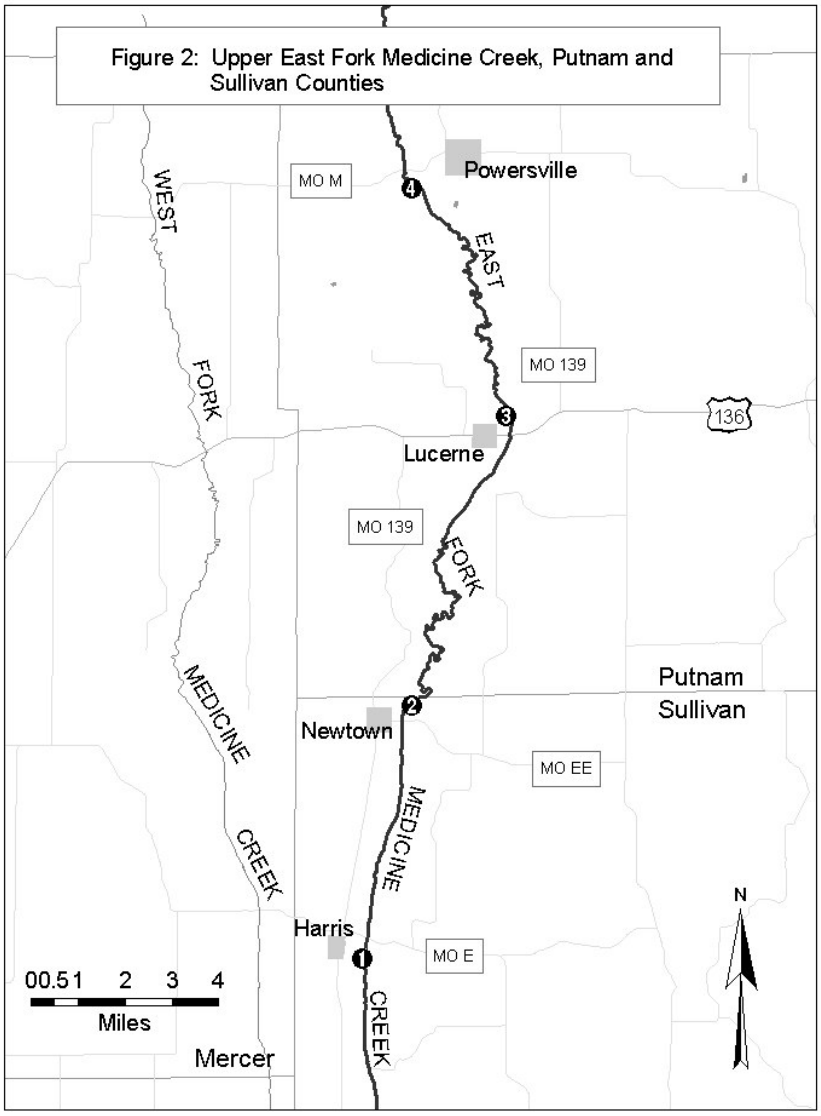


Figure 1: West Fork Medicine Creek, and East Fork Medicine Creek in the Plains/Grand/Chariton EDU
West Fork Medicine Creek
East Fork Medicine Creek
Plains/Grand/Chariton EDU
0 5 10 20 30 40
Miles
N

Appendix B

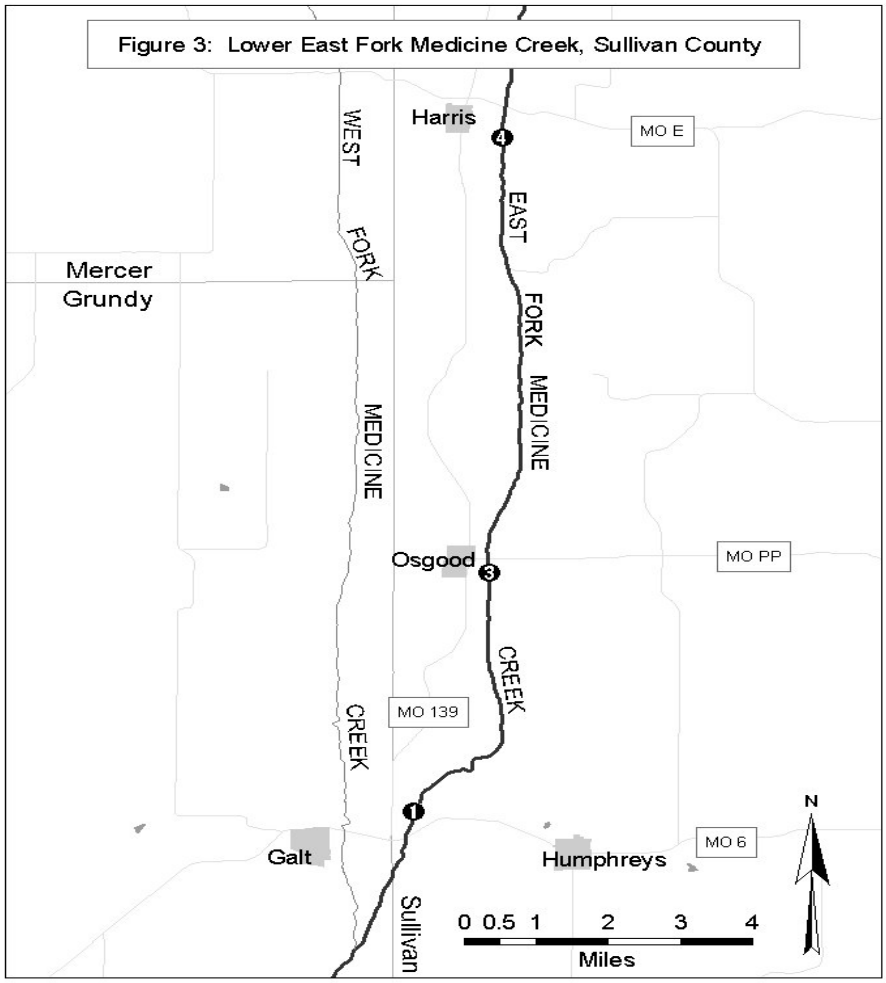
Map of East Fork Medicine Creek, impaired segment and sampling sites (upper segment)



1- located upstream of Highway E crossing, east of Harris, in Sullivan County.
2- located upstream from Highway EE crossing, east of Newton, in Sullivan County.
3- located upstream of the Highway 136 bridge, east of Lucerne, in Putnam
4- located downstream of the Highway M bridge, west of Powersville, in Putnam County.

Appendix C

Map of East Fork Medicine Creek, impaired segment and sampling sites (lower segment)



Site Index

1- locate approximately upstream from Highway 6 crossing, east of Galt, in Sullivan County.

3- located approximately downstream from Highway PP crossing, east of Osgood, in Sullivan County.

4- located approximately downstream from the Highway E crossing, east of Harris, in Sullivan

Appendix D

List of Sites used for TMDL methodology

USGS stream gages used to generate synthetic flow

Grand River nr Gallatin	06897500
Thompson River at Trenton	06899500
Grand River nr Sumner	06902000
East Fork Little Chariton nr Huntsville	06906300
Mussel Fork nr Mussel Fork	06906000
East Fork Little Chariton nr Macon	06906200

USGS stream sample sites used to generate EDU TMDL

Chariton River nr Prairie Hill	06905500
Mussel Fork nr Mystic	06905725
Mussel Fork nr Mussel Fork	06906000
North River nr Dunlap	06899580
Thompson River nr Mount Moriah	06898100
Weldon River nr Princeton	06898800
Little Medicine Creek nr Harris	06900100
Locust Creek nr Unionville	06900900
East Fork Little Chariton nr Macon	06906200
East Fork Little Chariton nr Huntsville	06906300
Medicine Creek nr Harris	06899950

Appendix E

Development of Suspended Sediment Targets using Reference Load Duration Curves

Overview

This procedure is used when a lotic system is placed on the 303(d) impaired waterbody list for a pollutant and the designated use being addressed is aquatic life. In cases where pollutant data for the impaired stream is not available a reference approach is used. The target for pollutant loading is the 25th percentile calculated from all data available within the ecological drainage unit (EDU) in which the waterbody is located. Additionally, it is also unlikely that a flow record for the impaired stream is available. If this is the case a synthetic flow record is needed. In order to develop a synthetic flow record calculate an average of the log discharge per square mile of USGS gaged rivers for which the drainage area is entirely contained within the EDU. From this synthetic record develop a flow duration from which to build a load duration curve for the pollutant within the EDU.

From this population of load durations follow the reference method used in setting nutrient targets in lakes and reservoirs. In this methodology the average concentration of either the 75th percentile of reference lakes or the 25th percentile of all lakes in the region is targeted in the TMDL. For most cases available pollutant data for reference streams is also not likely to be available. Therefore, follow the alternative method and target the 25th percentile of load duration of the available data within the EDU as the TMDL load duration curve. During periods of low flow the actual pollutant concentration may be more important than load. To account for this during periods of low flow the load duration curve uses the 25th percentile of EDU concentration at flows where surface runoff is less than 1% of the stream flow. This result in an inflection point in the curve below which the TMDL is calculated using load calculated with this reference concentration.

Methodology

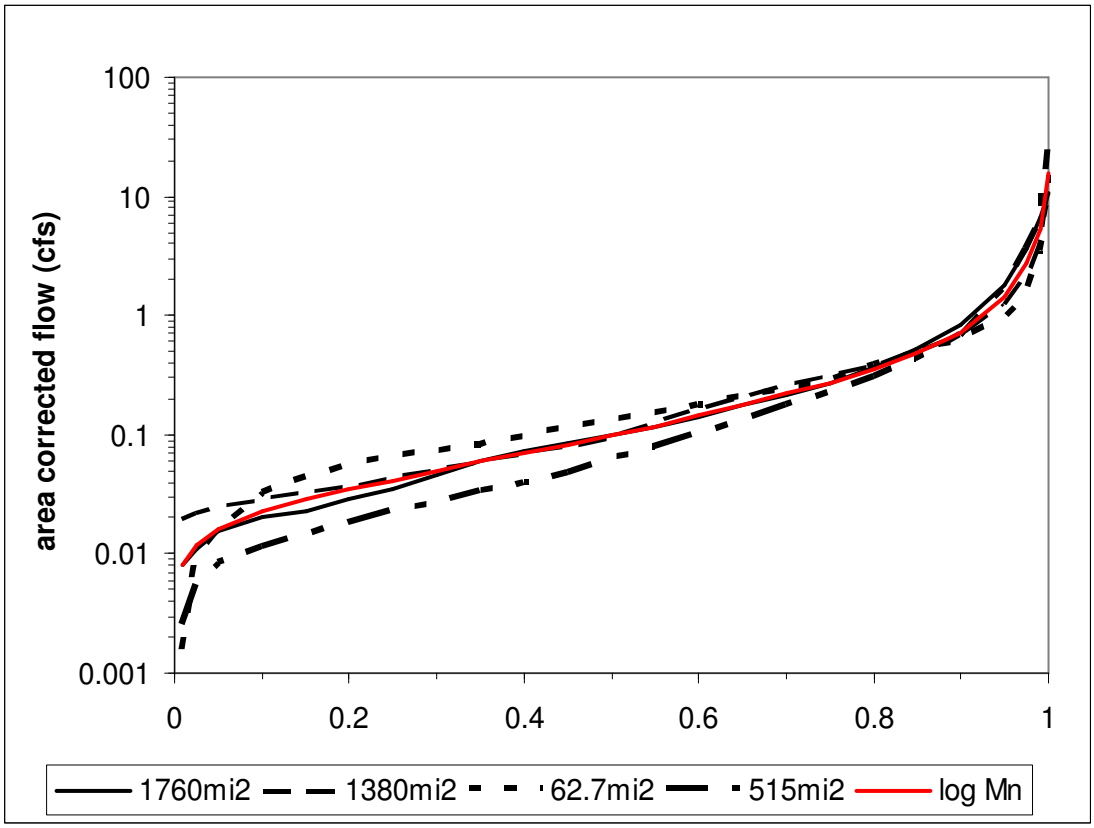
The first step in this procedure is to locate available pollutant data within the EDU of interest. These data along with the instantaneous flow measurement taken at the time of sample collection for the specific date are recorded to create the population from which to develop the load duration. Both the date and pollutant concentration are needed in order to match the measured data to the synthetic EDU flow record.

Secondly, collect average daily flow data for gages with a variety of drainage areas for a period of time to cover the pollutant record. From these flow records normalize the flow to a per square mile basis. Average the log transformations of the

average daily discharge for each day in the period of record. For each gage record used to build this synthetic flow record calculate the Nash-Sutcliffe statistic to determine if the relationship is valid for each record. This relationship must be valid in order to use this methodology. This new synthetic record of flow per square mile is used to develop the load duration for the EDU. The flow record should be of sufficient length to be able to calculate percentiles of flow.

The following examples show the application of the approach to one Missouri EDU.

The watershed-size normalized data for the individual gages in the EDU were calculated and compared to a pooled data set including all of the gages. The result of this analysis is displayed in the following figure and table:

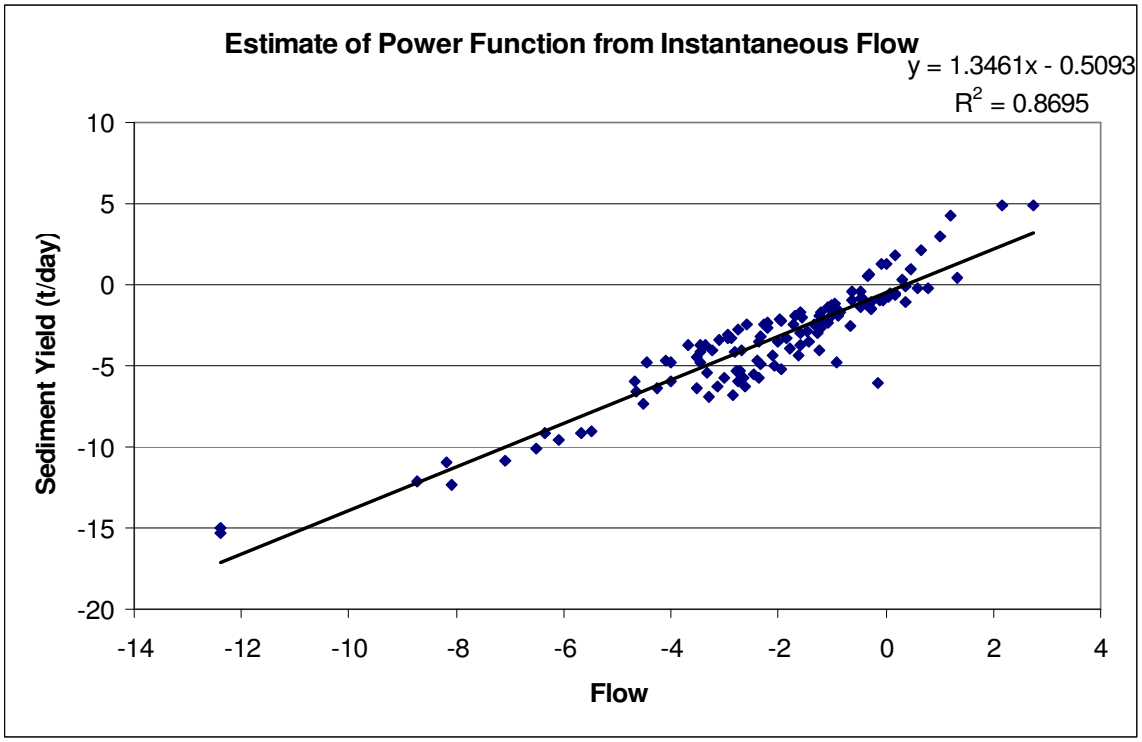


Gage	gage	area (mi^2)	normal Nash-Sutcliffe	lognormal Nash-Sutcliffe
Platte River	06820500	1760	80%	99%
Nodaway River	06817700	1380	90%	96%
Squaw Creek	06815575	62.7	86%	95%

102 River	06819500	515	99%	96%

This demonstrates the pooled data set can confidently be used as a surrogate for the EDU analyses.

The next step is to calculate pollutant-discharge relationships for the EDU, these are log transformed data for the yield (tons/mi^2/day) and the instantaneous flow (cfs/mi^2.) The following graph shows the EDU relationship:



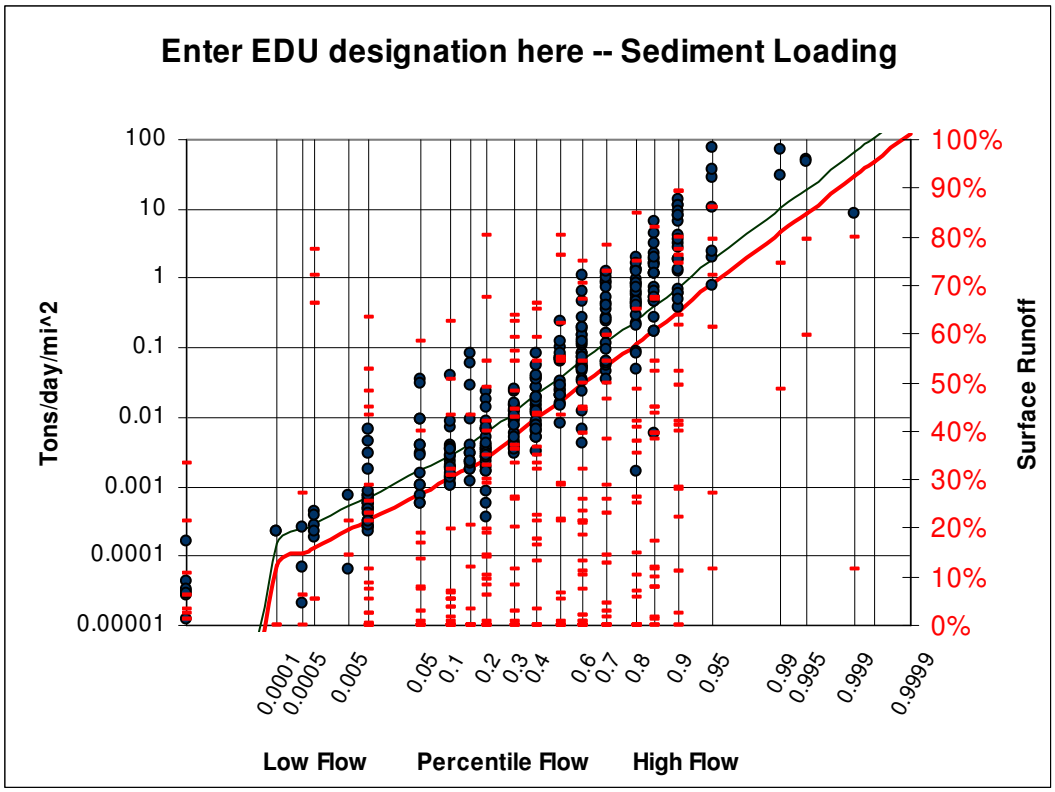
Further statistical analyses on this relationship are included in the following Table:

m	1.34608498	b	-0.509320019
Standard Error (m)	0.04721684	Standard Error (b)	0.152201589
r^2	0.86948229	Standard Error (y)	1.269553159
F	812.739077	DF	122
SSreg	1309.94458	SSres	196.6353573

The standard error of y was used to estimate the 25%ile level for the TMDL line. This was done by adjusting the intercept (b) by subtracting the product of the one-sided Z_{75} statistic times the standard error of (y). The resulting TMDL Equation is the following:

*Sediment yield (t/day/mi^2) = exp (1.34608498 * ln (flow) - 1.36627)*

A resulting pooled TMDL of all data in the watershed is shown in the following graph:



To apply this process to a specific watershed would entail using the individual watershed data compared to the above TMDL curve that has been multiplied by the watershed area. Data from the impaired segment is then plotted as a load (tons/day) for the y-axis and as the percentile of flow for the EDU on the day the sample was taken for the x-axis.

For more information contact:
Environmental Protection Agency, Region 7
Water, Wetlands, and Pesticides Division
Total Maximum Daily Load Program
901 North 5th Street
Kansas City, Kansas 66101
Website: http://www.epa.gov/region07/water/tmdl.htm

Appendix F

Biological Assessment and Habitat Study

East Fork Medicine Creek
Putnam and Sullivan Counties

2003-2005

Prepared for:

Missouri Department of Natural Resources
Division of Environmental Quality
Water Protection Program
Water Pollution Branch

Prepared by:

Missouri Department of Natural Resources
Field Services Division
Environmental Services Program
Water Quality Monitoring Section

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1.0 Introduction

At the request of the Missouri Department of Natural Resources **(MDNR)**, Water Protection Program **(WPP)**, the Environmental Services Program **(ESP)**, Water Quality Monitoring Section **(WQMS)** conducted a macroinvertebrate bioassessment and habitat study of East Fork Medicine Creek in Putnam and Sullivan Counties in north central Missouri.

Approximately 36 miles of East Fork Medicine Creek (virtually the entire stream length from the Iowa border to just south of Galt, Missouri) is included on the 2002 303(d) list for Total Maximum Daily Load (TMDL) development due to non-point source agriculture sediment pollution. The 303(d) list does not include habitat loss as an impact. However, all of East Fork Medicine Creek has poor aquatic habitat. The degraded habitat and excessive sediment load have been caused by erosion from agricultural lands, stream bank erosion, loss of stream length and heterogeneity due to channelization, and changes in the basin hydrology. Most of the deposition consists of sand; silt and clay are largely transported downstream to the Mississippi River.

Limitations of time and personnel necessitated dividing the study into an upper and lower portion over a two-year interval. An upper 23-mile section of East Fork Medicine Creek was sampled in the fall of 2003 and spring of 2004. Sampling of the remaining 13 miles of stream was conducted in the fall of 2004 and spring of 2005.

1.1 Purpose

The purpose of the study was to determine if the East Fork Medicine Creek macroinvertebrate community was impaired and, if so, determine possible causes.

1.2 Objectives

1) Define the habitat characteristics of East Fork Medicine Creek.

2) Define the water quality characteristics of East Fork Medicine Creek.

3) Determine if the macroinvertebrate community and water quality of East Fork Medicine Creek are impaired by factors related to habitat loss.

1.3 Tasks

1) Conduct a habitat assessment of East Fork Medicine Creek.

2) Conduct a water quality assessment of East Fork Medicine Creek.

3) Conduct a bioassessment of the macroinvertebrate community of East Fork Medicine Creek.

1.4 Null Hypotheses

Habitat quality, water quality, and macroinvertebrate assemblages are similar among East Fork Medicine Creek stream segments.

Habitat quality, water quality, and macroinvertebrate assemblages are similar between East Fork Medicine Creek and biocriteria reference streams within the Plains/Grand/Chariton Ecological Drainage Unit **(EDU)**.

2.0 Study Area

East Fork Medicine Creek originates in Iowa and flows into Missouri northwest of Powersville, in Putnam County. The creek flows through Putnam, Sullivan, and Grundy Counties for 36 miles before it joins with West Fork Medicine Creek, south of Galt, Missouri, to form Medicine Creek in Grundy County. Total watershed including tributaries is approximately 257 square miles. East Fork Medicine Creek is considered a permanently flowing class "P" stream by the Missouri Water Quality Standards (MDNR 2000). Beneficial use designations are "Livestock and Wildlife Watering **(LWW)**, and Protection of Warm Water Aquatic Life and Human Health-Fish Consumption **(AQL)**".

2.1 Water Quality Concerns

There are no major point sources of pollution in the East Fork Medicine Creek watershed. Non-point source impacts from farming and agricultural industry are of much greater concern. Agriculture is a major industry within northern Missouri and the Grand River basin, including row crops, pasturing of cattle, and concentrated animal feeding operations **(CAFOs)**. Although there are no CAFOs in the East Fork Medicine Creek watershed, there is potential for runoff and groundwater infiltration via land application from CAFOs located in the nearby West Medicine Creek catchment.

Erosion of cropland is a major cause of silt and sand sediment load in northern Missouri streams. In addition, row crops are often planted to the edge of stream banks that have been denuded of riparian vegetation, causing steep, shadeless, unstable banks, high summer water temperatures, and loss of stream habitat. Pastured cattle often have access to streams and contribute organic and bacterial loading, destruction of stream banks, and increased turbidity and siltation. Many northern Missouri streams have various degrees of channelization to provide more area in the river bottoms for cropland. Channelization causes a loss of channel structure and subsequent deterioration and destruction of stream habitats.

2.2 East Fork Medicine Creek Site Descriptions

Seven stations were sampled along the approximately 36-mile length of East Fork Medicine Creek. Four stations sampled along the upper 23 miles of the stream during fall of 2003 and spring of 2004 will hereafter be referred to as Upper East Fork Medicine Creek **(UEFMC)**. UEFMC stations #1 and #2 were located in Sullivan County and UEFMC stations #3 and #4 were sited in Putnam County. Upper East Fork Medicine Creek was slightly above normal flow, but below the top of the lower banks, during the fall 2003 sampling period due to rainfall a few days earlier. The stream was sand-bottomed, turbid, and mostly consisted of a narrow, shallow meander within a much wider channel. Beaver ponds and dams were present at several stations. During the spring 2004 sampling UEFMC was slightly above normal stream stage, moderately swift, and turbid. High flows during the winter and early spring had scoured banks, caused bank failure, and had destroyed several beaver dams. In fall 2004, four stations were chosen along the

remaining 13 miles of stream. However, the second station had to be deleted from the study because of poor access and water too deep for wading. The remaining three stations will be referred to as Lower East Fork Medicine Creek **(LEFMC)**. These three stations were located in Sullivan County. Lower East Fork Medicine Creek in fall 2004 was slightly above ambient stream stage and flow, and had considerable instream deposition of sand. High stream flows in late summer 2004 had overtopped banks, which were sloughed and disturbed in several places. Similar stream conditions at LEFMC were present during spring 2005 sampling, following late winter flooding. See Figures 1, 2, and 3 for maps of East Fork Medicine Creek study locations.

Station UEFMC #1: (S ½ sec. 26, T. 64 N., R. 22 W.) was located upstream of the Highway E crossing, east of Harris, in Sullivan County. Sampling was conducted approximately one-quarter mile upstream from the crossing. Macroinvertebrate habitat was fair in fall 2003, but poor in spring 2004 because of eroded banks and unconsolidated sand substrate. Decimal degree coordinates for this station are Latitude 40.30935762, Longitude –93.33813705.

Stations UEFMC #2 and #2.5: (NW ¼ sec. 1, T. 64 N., R. 22 W.) were located upstream from the Highway EE crossing, east of Newtown, in Sullivan County. Water quality samples were collected at UEFMC #2 just upstream from the bridge at geographic coordinates Latitude 40.37618761, Longitude –93.32442771. The UEFMC #2 segment was a flowing reach that extended from the bridge upstream a few hundred feet to the confluence with Barber Creek. The first of two beaver dams was located just upstream from Barber Creek. The UEFMC #2.5 reach began at the Barber Creek confluence and extended upstream for several hundred yards above the beaver dams. This entire segment was essentially a non-flowing pool. By the spring of 2004, the UEFMC #2 and #2.5 reaches had been altered by high flows, which breached and partially destroyed the beaver dams, leaving an entirely flowing stream segment. Therefore, in the spring, only one macroinvertebrate sample was collected, and the station was designated UEFMC #2.

Station UEFMC #3: (N ½ sec. 5, T. 65 N., R. 21 W.) was located upstream of the Highway 136 bridge, east of Lucerne, in Putnam County. In the fall of 2003, a long beaver pool began at the bridge and stretched upstream past the top of the sample reach. Fall 2003 macroinvertebrate sampling at this station thus consisted of non-flow habitat only. By spring 2004 the beaver dam had been breached and all three macroinvertebrate habitats were sampled. Decimal degree coordinates for this station are Latitude 40.46910213, Longitude –93.28046949.

Station UEFMC #4: (NE ¼ sec. 12, T. 66 N., R. 22 W.) was located downstream of the Highway M bridge, west of Powersville, in Putnam County. This station had fairly good macroinvertebrate habitat with stream banks in good condition and trees extended to the water's edge in several locations. Decimal degree coordinates for this station are Latitude 40.54402762, Longitude –93.54402762.

Station LEFMC #1: (NE ¼ sec. 34, T. 64 N., R. 22 W.) was located upstream from the Highway 6 crossing, east of Galt, in Sullivan County. A very long bridge pool necessitated

macroinvertebrate sampling to begin approximately one-third mile upstream. Macroinvertebrate habitat was judged to be poor. There were few pools, which were either scoured or filled with

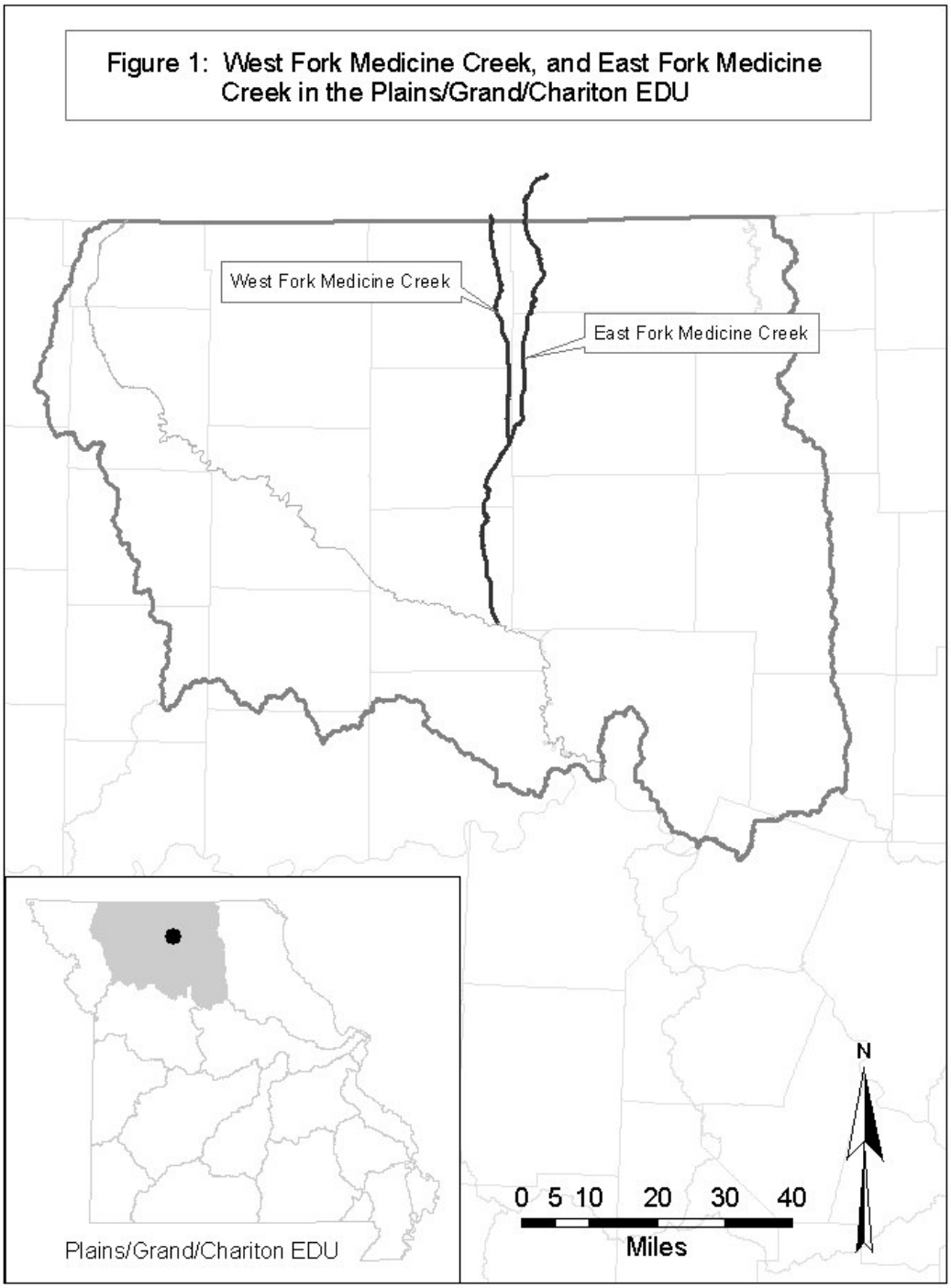
Figure 1: West Fork Medicine Creek, and East Fork Medicine Creek in the Plains/Grand/Chariton EDU
West Fork Medicine Creek
East Fork Medicine Creek
Plains/Grand/Chariton EDU
N
0 5 10 20 30 40
Miles

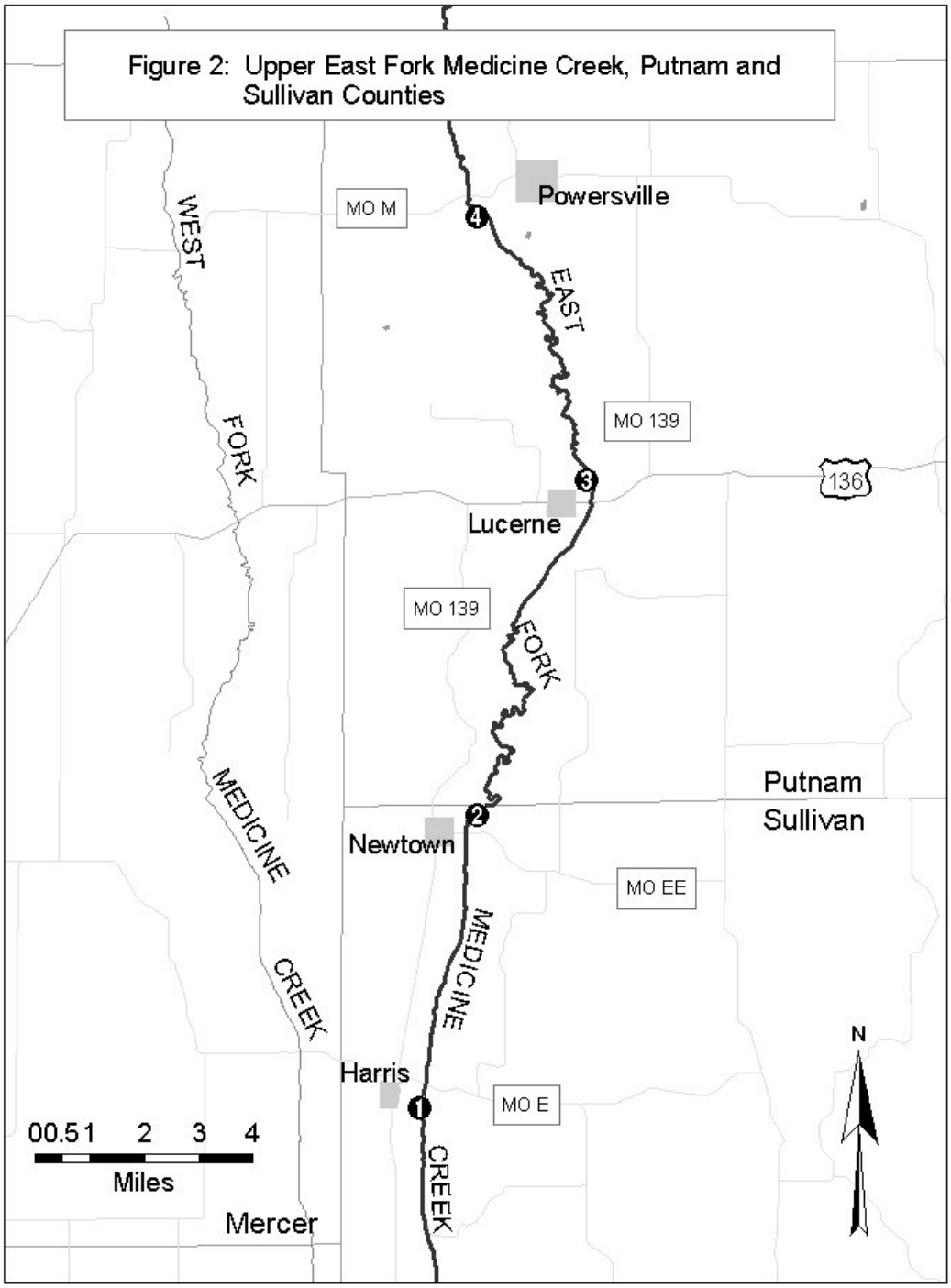
Figure 2: Upper East Fork Medicine Creek, Putnam and Sullivan Counties
Powersville
MO M
WEST
FORK
MEDICINE
CREEK
EAST
FORK
MEDICINE
CREEK
MO 139
136
Lucerne
MO 139
Newtown
MO EE
Harris
MO E
Putnam
Sullivan
Mercer
0 0.5 1 2 3 4
Miles
N
1
2
3
4

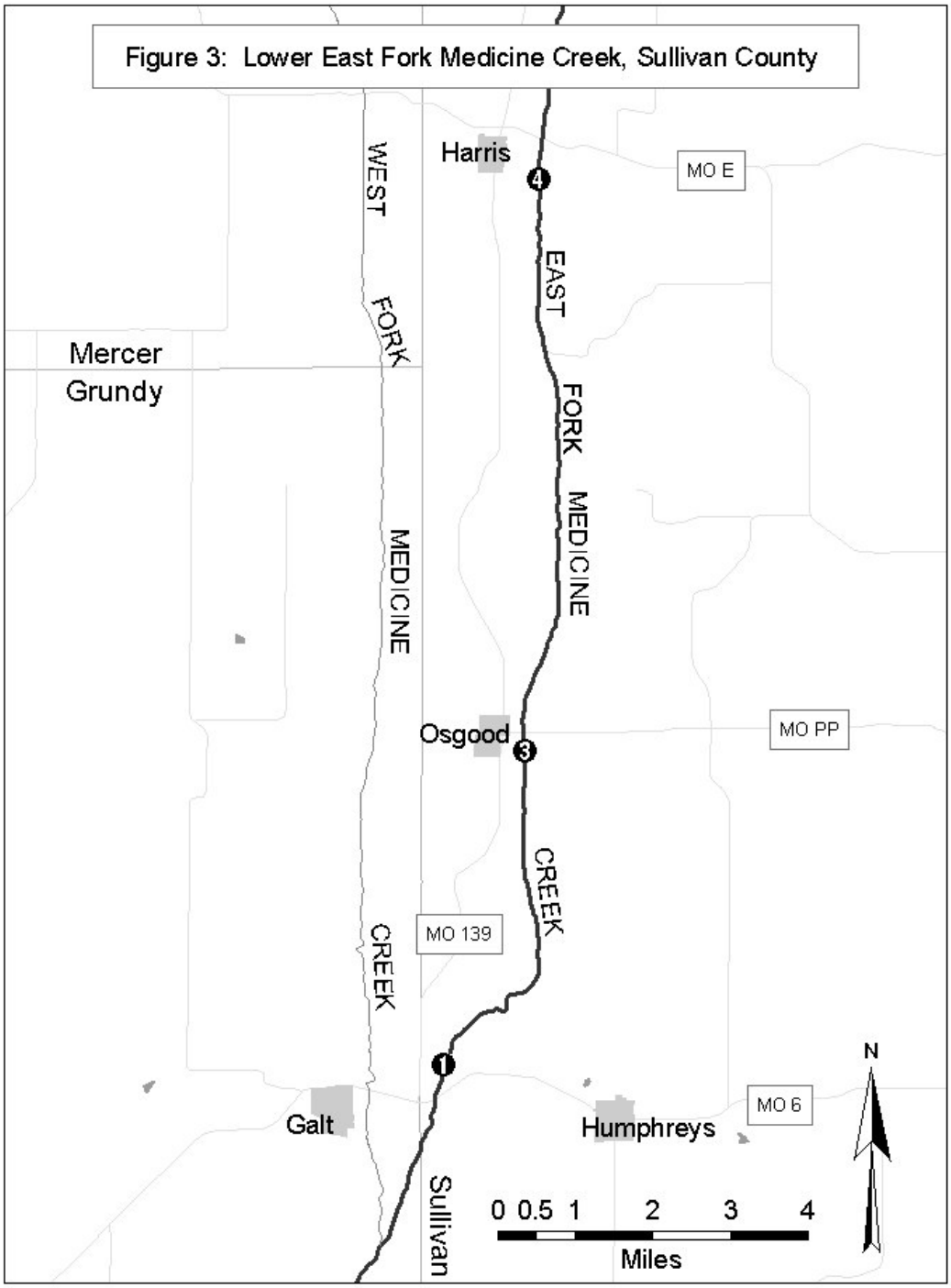
Figure 3: Lower East Fork Medicine Creek, Sullivan County
Harris
MO E
WEST FORK MEDICINE CREEK
EAST FORK MEDICINE CREEK
Mercer
Grundy
Osgood
MO PP
MO 139
Galt
Humphreys
MO 6
Sullivan
N
0 0.5 1 2 3 4
Miles

rather deep, unconsolidated silty-sand substrate. Root-mat was sparse and of fair to poor quality. In spite of these observations, LEFMC #1 supported a fairly diverse macroinvertebrate fauna. Decimal degree coordinates for this station are Latitude 40.129796, Longitude –93.363041.

Station LEFMC #3: (SW ¼ sec. 2, T. 62 N., R. 22 W.) was located downstream from the Highway PP crossing, east of Osgood, in Sullivan County. Macroinvertebrate habitat was fair. There was a fairly good mix of shallow and deep pools. Substrate was rather firm compared to upstream and downstream stations. This station also had several short riffle and run sequences. Decimal degree coordinates for this station are Latitude 40.301996, Longitude –93.338434.

Station LEFMC #4: (N ½ sec. 35, T. 64 N., R. 22 W.) was located downstream from the Highway E crossing, east of Harris, in Sullivan County. Substrate was very soft silty-sand and over one foot deep in many places, and wading was very difficult. There were a few deep pools three to four feet deep. Decimal degree coordinates for this station are Latitude 40.197093, Longitude –93.341905.

3.0 Methods

Steve Humphrey, Cecilia Campbell, and other staff of the MDNR, ESP conducted this study. Sampling of UEFMC was conducted in the fall of 2003 and spring of 2004. The LEFMC sampling was conducted in the fall of 2004 and spring of 2005. Macroinvertebrates and water quality were sampled each season. Habitat assessments were conducted during the fall.

3.1 Habitat

East Fork Medicine Creek **(EFMC)** was placed on the federal 303(d) list for stream habitat degradation due to excessive sedimentation. Little sediment data exists to directly document sediment as a significant impact to the stream. General fisheries data and the effect of sediment on fish were the initial data used to consider EFMC for 303(d) listing. Sedimentation is one of many instream habitat problems associated with land use. Although instream habitat can be directly measured, the causes of the degradation can range from local scale sources to watershed scale sources. We collected habitat measures at the watershed, reach, and local scales to better allow us to evaluate the causes of poor habitat conditions.

3.1.1 Land Use

The land use conditions were summarized from land cover Geographic Information System (GIS) files. These land cover files were provided by the Missouri Resource Assessment Partnership (MoRAP) and derived from 2000-2004 LANDSTAT data.

3.1.2 Habitat Assessment and Riparian Zone Condition

A standardized assessment procedure was followed as described for Glide/Pool Habitat in the Stream Habitat Assessment Project Procedure (SHAPP) (MDNR 2003a). Habitat assessments were conducted during September 2003 at UEFMC and during September 2004 at LEFMC.

The riparian zone condition was observed and qualitatively described as very poor, poor, good, very good, and mixed. Very poor riparian zone conditions are characterized by mostly or

entirely row crops and/or grassland up to the stream bank and no or very little trees or shrubs. Poor riparian zone conditions are characterized by row crops and/or grassland planted close to the stream bank, but with a thin zone of trees less than 20 feet wide remaining in the riparian zone. Fair to good riparian zone conditions are characterized by a riparian zone of 20 to 60 feet wide in front of row crops and/or grassland. Very good riparian zone conditions are characterized by little influence from row crops, abundant forest coverage, and a riparian zone greater than 60 feet wide. Mixed riparian zone conditions are characterized by having one side of the stream rated differently than the other (e.g., very poor and good).

3.1.3 Sinuosity

Sinuosity was estimated by using a ratio of the length of the stream between two points to the straight line distance between two points. The two points were located two miles apart and the sample station was contained within this two-mile reach of stream. The measurements and calculations were derived by using data from the United States Geological Survey's National Hydrography Database.

3.1.4 Stream Width and Depth Measurements

Lack of instream habitat is typical of wide and shallow northern Missouri streams. Wider, shallower streams tend to have less ability to develop pools and retain woody debris (Haithcoat et al. 2003). Stream width and depth measurements were collected to characterize stream structure. At each sampling station a series of 10 bank to bank transects were established. Each transect was equally spaced within the sampling reach, which was 20x the average width. Measurements taken at each transect included lower bank width (see SHAPP for a definition of Lower Bank), wetted width, and water depth at ¼, ½, and ¾ of the distance across the wetted width. In order to document critical habitat conditions, measurements were collected during the fall low flow period.

3.2 Physicochemical Water Parameters

Physical and chemical water samples were collected from all stations each season. Parameters were nitrate plus nitrite-nitrogen, ammonia-nitrogen, total Kjeldahl nitrogen, chloride, turbidity, temperature, conductivity, dissolved oxygen, pH, and discharge. WQMS personnel analyzed temperature, conductivity, dissolved oxygen, pH, and discharge in the field and turbidity in the biology laboratory. All other parameters were delivered to the ESP, Chemical Analyses Section for analyses. All samples were collected according to the standard operating procedure MDNR-FSS-001: Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations (MDNR 2002a) and were recorded on an MDNR chain-of-custody (MDNR 2001).

3.3 Biological Assessment

The biological assessment was conducted according to the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure **(SMSBPP)** (MDNR 2003b). Upper East Fork Medicine Creek was sampled September 2003 and April 2004. Lower East Fork Medicine Creek was sampled September 2004 and March 2005. Three standard habitats of glide/pool streams (e.g., woody debris substrate, depositional substrate in non-flowing water, and root-mat substrate) were sampled at all locations.

Macroinvertebrate data were evaluated by comparison to Biological Criteria for Perennial/Wadeable Streams of Missouri (MDNR 2002b, with an updated Appendix B) within the Plains/Grand/Chariton Ecological Drainage Unit **(EDU**). An EDU is an ecological area in which the aquatic biological communities and stream habitat can be expected to be similar.

Macroinvertebrate scores were analyzed each season using two methods. The first analysis was a metric evaluation, per the SMSBPP, versus biological criteria. The SMSBPP provides details on the calculation of metrics and scoring of the multi-metric Macroinvertebrate Stream Condition Index **(MSCI)**. The four core metrics of the MSCI are: Taxa Richness **(TR)**; Ephemeroptera, Plecoptera, and Trichoptera Taxa Richness **(EPTT)**; Biotic Index **(BI)**; and the Shannon Diversity Index **(SDI)**. An MSCI score of 16-20 is considered full biological supporting, 10-14 is partial biological supporting, and 4-8 is non-supporting. Tables 1 and 2 provide scoring criteria for the fall and spring index periods, respectively.

The second analysis of the biological data was an evaluation of the dominant macroinvertebrate families **(DMF)** using percent composition of predominant macroinvertebrate taxa.

Table 1
Biological Criteria for Glide/Pool-Fall Index Period
Plains/Grand/Chariton EDU

Metric	Score = 1	Score = 3	Score = 5
TR	< 26	26 – 51	> 51
EPTT	< 4	4 – 9	> 9
BI	> 8.60	8.60 – 7.20	< 7.20
SDI	< 1.34	1.34 – 2.68	> 2.68

Table 2
Biological Criteria for Glide/Pool-Spring Index Period
Plains/Grand/Chariton EDU

Metric	Score = 1	Score = 3	Score = 5
TR	< 26	26 – 51	> 51
EPTT	< 4	4 – 8	> 8
BI	> 8.61	8.61 – 7.24	< 7.24
SDI	< 1.26	1.26 – 2.53	> 2.53

4.0 Results and Analyses

4.1 Land Use

Table 3 lists the land cover percentages for the Plains/Grand/Chariton EDU, Upper East Fork Medicine Creek (UEFMC), Lower East Fork Medicine Creek (LEFMC), and three Biological Criteria for Wadeable/Perennial Streams (**BIOREF**) stations. Stations UEFMC #1 and #2 have land coverages similar to the EDU, with about one-fourth row-cropped and one-half as grassland. The three LEFMC stations also have coverages similar to UEFMC #1 and #2 and the

EDU. The furthest upstream stations, UEFMC #3 and #4, have a much smaller row-crop coverage and somewhat greater percent grassland cover than UEFMC #1 and #2 and the EDU. This indicates that UEFMC #3 and #4 may be less impacted by row cropping than the remaining UEFMC and LEFMC stations.

Locust Creek BIOREF and West Locust Creek BIOREF stations have nearly identical coverages of 10 to 11 percent row crop, 60 to 62 percent grassland, and 20 to 21 percent forest. The land use of the two stations is similar to UEFMC #3 and #4, with somewhat less row cropping in the reference watersheds. The Spring Creek BIOREF differs substantially from EFMC and the other BIOREF stations. More than one-half (55%) of the watershed is forested and grassland accounts for only 28 percent of the coverage. The percent row crop coverage of Spring Creek BIOREF is 10 percent.

Table 3
Land Use

Watershed	% Urban	% Row Crops	% Grassland	% Forest	% Other
Plains/Grand/Chariton EDU	2	28	45	18	7
UEFMC #1 & #2	2	26	49	17	6
UEFMC #3	2	14	62	16	6
UEFMC #4	1	15	55	22	7
LEFMC #1, #3, & #4	2	26	49	17	6
Spring Creek BIOREF	1	10	28	55	6
Locust Creek BIOREF	2	10	62	20	6
West Locust Creek BIOREF	1	11	60	21	7

4.2 Habitat Assessment

Habitat assessment scores for each UEFMC and LEFMC station are given in Table 4. For comparison, the West Locust Creek BIOREF habitat score is provided along with the percent of the BIOREF score achieved by each EFMC station. The Locust Creek BIOREF habitat assessment score was excluded from the table because flooding prior to assessment had caused significant erosion and sloughing of stream banks and considerable deposition of silt and sand within pools. This resulted in an unusually low BIOREF habitat assessment score of only 83 for the Locust Creek BIOREF. All habitat scores of EFMC exceeded 75 percent similarity of the West Locust Creek reference stream, so the aquatic macroinvertebrate communities among the stations may be seen to be comparable. Habitat assessment scores of LEFMC #3 and #4 were 76 and 80, respectively. The lower scores reflected degraded habitat following flooding in late August 2004.

4.3 Sinuosity and Riparian Zone Condition

Table 5 lists sinuosity, channelization likelihood, and riparian zone condition for each UEFMC and LEFMC station and the West Locust Creek and Locust Creek BIOREF stations. Points were chosen along Medicine Creek at approximately two miles apart, incorporating each sampling station in the center of the reach. Similarly, West Locust and Locust Creek BIOREF sinuosity determinations were calculated from the middle of the sampling reach.

Table 4
Upper East Fork Medicine Creek, Lower East Fork Medicine Creek, and West Locust Creek BIOREF Habitat Assessment Scores

Station	Habitat Assessment Score	Percent of BIOREF
UEFMC #1	93	95
UEFMC #2	95	97
UEFMC #3	109	111
UEFMC #4	97	99
LEFMC #1	90	92
LEFMC #3	76	78
LEFMC #4	80	82
West Locust Creek BIOREF	98	

Table 5
Upper East Fork Medicine Creek, Lower East Fork Medicine Creek, West Locust Creek BIOREF and Locust Creek BIOREF Sinuosity and Riparian Zone Conditions

Station	*Sinuosity (miles/mile)	Likely to be Channelized	Riparian Zone Condition
UEFMC #1	1.01	Yes	Good
UEFMC #2	1.14	Probably	Fair
UEFMC #3	1.20	Probably	Fair/Good
UEFMC #4	1.16	Probably	Good
LEFMC #1	1.04	Yes	Very Good
LEFMC #3	1.02	Yes	Fair
LEFMC #4	1.02	Yes	Good
West Locust Creek BIOREF	1.43	No	Very Good
Locust Creek BIOREF	1.04	Yes	Mixed**

*Higher number equates to greater sinuosity
** Left descending bank rated poor; right descending bank rated good.

4.4 Stream Width and Depth Measurements

Transect measurements for average channel width (= lower bank width), average wetted width, and average stream depth for UEFMC, LEFMC, and the Plains/Grand/Chariton EDU BIOREF stations are presented in Table 6. The BIOREF data represent an average of nine channel measurements at eight BIOREF stations within the EDU. Also provided in Table 6 are two columns of ratios: channel width to wetted width and wetted width to depth. The ratios allow the standardization of channel measurements for longitudinal comparisons along a stream. For example, channel width normally widens as one proceeds downstream. Wetted width and depth do not necessarily increase as one proceeds downstream. By incorporating ratios of channel width to wetted width and wetted width to depth, channel widths and depths can be compared along a stream reach.

The average channel width of EFMC ranged from 27.2 feet at the farthest upstream station UEFMC #4 to 86.6 feet at the farthest downstream station LEFMC #1. Average wetted width was variable among the seven EFMC stations but increased upstream to downstream from 19.0 feet at UEFMC #4 to 59.0 feet at LFMC #1. Average depth also increased from upstream to downstream and ranged from 0.44 feet at UEFMC #4 to 1.36 feet at LEFMC #1.

Channel width to wetted width ratio increased overall from upstream to downstream at UEFMC. This ratio was nearly the same at UEFMC stations #4 and #3, but then increased to 2.0 at UEFMC #2 and increased further to 2.9 at UEFMC #1. The increase in the ratio from upstream to downstream at UEFMC indicates that a smaller proportion of the stream channel was wetted at the downstream stations UEFMC #1 and #2. At LEFMC stations, the ratio was lower and more uniform among the three stations and ranged from 1.2 to 1.5, or about the same as the ratio at UEFMC #3 and #4. This indicates that the proportion of the wetted width of the channel increased, rather than decreased, from UEFMC stations #1 and #2 downstream to the LEFMC stations.

Overall, average depth increased, as expected, from 0.44 feet at the farthest upstream UEFMC station #4 to the most downstream LEFMC station #1, where the average depth was 1.36 feet. However, there was no obvious trend in the wetted width to depth ratio from upstream to downstream. The lowest ratios were at UEFMC stations #2 and #3, which indicates the stream was relatively deep in comparison to its wetted width at these stations.

The Plains/Grand/Chariton BIOREF values were overall most similar to UEFMC stations #2 and #3, which indicates that the stream morphology and depth regime of these two stations was more similar to the average for the BIOREF than were the values of the other EFMC stations.

Table 6
Upper East Fork Medicine Creek, Lower East Fork Medicine Creek, and Plains/Grand/Chariton BIOREF Streams, Width and Depth Summary

Station	Average Channel Width (ft)	Average Wetted Width (ft)	Average Depth (ft)	Channel Width/ Wetted Width	Wetted Width/ Depth
UEFMC #1	69.8	24.1	0.52	2.9	46.5
UEFMC #2	43.2	22.0	0.86	2.0	25.8
UEFMC #3	43.6	35.0	1.28	1.2	27.4
UEFMC #4	27.2	19.0	0.44	1.4	42.8
LEFMC #1	86.6	59.0	1.36	1.5	43.4
LEFMC #3	63.0	45.5	1.05	1.4	43.3
LEFMC #4	70.4	56.4	0.95	1.2	59.4
P/G/C BIOREF	42.5	26.5	1.0	1.6	26.5

4.5 Physicochemical Results

Upper East Fork Medicine Creek (UEFMC) physicochemical data are presented in Tables 7 and 8. Spring Creek BIOREF control data from spring 2004 are also included in Table 8. Spring Creek was not sampled in fall 2003. Lower East Fork Medicine Creek physicochemical data from fall 2004 and spring 2005 are given in Tables 9 and 10. West Locust Creek and Locust Creek BIOREF control data are included in each LEFMC table.

Physicochemical data from September 2003 at the four UEFMC stations are listed in Table 7. Although there were no violations of water quality standards, the concentrations of three parameters are notable. Turbidity at all stations was elevated, and the highest reading of 187 NTU was recorded at station #4, the farthest upstream station. Turbidity readings decreased downstream, and the lowest turbidity (79.8 NTU) was measured at station #1.

The trend of decreasing concentrations of parameters from upstream to downstream was also exhibited in the values of total phosphorus and total Kjeldahl nitrogen, and to a lesser extent in the chloride and nitrate plus nitrite-nitrogen concentrations. Total phosphorus concentrations were extremely high at upstream station #4, where total phosphorus measured 7.57 mg/L. Values decreased to 0.67 mg/L at station #3, 0.34 mg/L at station #2, and 0.21 mg/L at station #1. Similarly, total Kjeldahl nitrogen values decreased from 2.27 mg/L at station #4 to 0.76 mg/L at station #1.

Conductivity measurements at all four stations were within 52 µmhos of each other and remained fairly low. Stream flow was near ambient values. Stations #4 and #3 discharges measured 1.3 cubic feet per second (cfs). Stream flow increased roughly four-fold at stations #1 and #2, and the highest flow among the four stations was 5.1 cfs at station #2.

Table 7
Physicochemical Results for Upper East Fork Medicine Creek, September 2003

Variable-Station	UEFMC #1	UEFMC #2	UEFMC #3	UEFMC #4
Sample Number	03-37311	03-37310	03-37309	03-37308
pH (Units)	7.6	7.7	8.0	7.6
Temp. (C°)	14.0	20.0	17.0	15.5
Cond. (uS)	352	329	300	320
Diss. O_2	8.9	8.7	8.3	8.4
Flow (cfs)	4.34	5.07	1.28	1.30
Turb. (NTU)	79.8	128	144	187
NH_3-N	< 0.03	< 0.03	< 0.03	< 0.03
NO_3/NO_2-N	0.22	0.26	0.41	0.55
TKN	0.76	0.98	1.33	**2.27**
Chloride	9.47	10.0	10.2	18.0
Total Phos.	0.21	0.34	0.67	**7.57**

Units mg/L unless otherwise noted

April 2004 UEFMC and Spring Creek BIOREF physicochemical results are given in Table 8. Concentrations of total Kjeldahl nitrogen and total phosphorus at all UEFMC stations were lower than values recorded in September 2003. Total phosphorus values in spring 2004 ranged from 0.13 mg/L at station #2, to 0.21 mg/L at station #4. These levels of total phosphorus were, however, much higher than the Spring Creek control sample, which measured only 0.03 mg/L. Nitrate plus nitrite-nitrogen levels in spring 2004 were higher than values recorded in fall 2003 at three of four UEFMC stations. The highest concentration of this parameter was 0.61 mg/L found at station #1. At the Spring Creek station, the total nitrate plus nitrite-nitrogen level was below the 0.01 mg/L detection limit.

Stream discharge was substantially higher at all UEFMC stations in spring 2005, but turbidity readings were substantially lower in the spring compared to fall 2004. Stream flow in April 2005 ranged from 7.37 cfs at upstream station #4 to 50 cfs at downstream station #1.

Table 8
Physicochemical Results for Upper East Fork Medicine Creek and Spring Creek BIOREF, April 2004

Variable-Station	UEFMC #1	UEFMC #2	UEFMC #3	UEFMC #4	Spring Creek #1
Sample Number	04-11716	04-11717	04-11718	04-11719	04-11722
pH (Units)	7.7	7.3	7.6	7.8	7.9
Temp. (C°)	17.0	14.0	14.0	18.0	17.5
Cond. (uS)	383	417	409	445	476
Diss. O_2	8.9	9.9	10.1	11.8	11.6
Flow (cfs)	50.0	39.3	25.6	7.37	7.13
Turb. (NTU)	28.9	8.45	22.2	8.43	3.61
NH_3-N	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
NO_3/NO_2-N	**0.61**	**0.55**	**0.43**	**0.34**	< 0.01
TKN	0.56	0.61	0.64	0.62	0.23
Chloride	12.3	12.7	10.9	13.3	7.75
Total Phos.	**0.14**	**0.13**	**0.20**	**0.21**	0.03

Units mg/L unless otherwise noted

Lower East Fork Medicine Creek physicochemical results from September 2004 are presented in Table 9. Data from two control stations, Locust Creek BIOREF and West Locust Creek BIOREF, are included for comparison to LEFMC. Values of most parameters were similar among the three LEFMC samples and LEFMC values were similar to control values. The one exception was West Locust Creek stream flow, which measured only 1.10 cfs.

Nutrient concentrations were generally low among all stations. Ammonia-nitrogen was not detected at any station and nitrate plus nitrite-nitrogen was below the 0.01 mg/L detection limit at each LEFMC station. The highest nitrate plus nitrite-nitrogen level was 0.11 mg/L and was measured at Locust Creek. Total Kjeldahl nitrogen levels among the five stations ranged from

0.39 mg/L at LEFMC to 0.74 mg/L at Locust Creek. Total phosphorus values were very similar among the five stations and ranged from 0.07 mg/L to 0.11 mg/L.

Table 9
Physicochemical Results for Lower East Fork Medicine Creek, Locust Creek BIOREF, and West Locust Creek BIOREF, September 2004

Variable-Station	LEFMC #1	LEFMC #3	LEFMC #4	Locust Creek #1	West Locust Creek #1
Sample Number	04-34863	04-34865	04-34864	04-34862	04-34870
pH (Units)	7.6	7.8	7.5	*	7.7
Temperature (C°)	19.3	19.3	18.4	21.1	15.4
Conductivity (µS)	455	466	468	400	439
Dissolved O_2	7.0	7.4	7.5	8.5	5.8
Flow (cfs)	17.6	13.6	10.5	8.32	1.10
Turbidity (NTU)	21.1	16.7	10.1	14.6	8.81
NH_3-N	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
NO_3/NO_2-N	< 0.01	< 0.01	< 0.01	0.11	0.01
TKN	0.63	0.43	0.39	0.74	0.60
Chloride	11.2	11.2	10.8	9.29	11.4
Total Phosphorus	0.10	0.09	0.07	0.11	0.07

* Not collected

Units mg/L unless otherwise noted

Table 10
Physicochemical Results for Lower East Fork Medicine Creek, Locust Creek BIOREF, and West Locust Creek BIOREF, March/April 2005

Variable-Station	LEFMC #1	LEFMC #3	LEFMC #4	Locust Creek #1	West Locust Creek #1
Sample Number	05-03166	05-03168	05-03169	05-03170	05-03171
pH (Units)	7.8	8.0	7.3	7.6	7.6
Temperature (C°)	14.9	21.9	14.1	15.1	16.8
Conductivity (µS)	482	479	492	493	470
Dissolved O_2	11.6	9.8	10.3	11.0	9.3
Flow (cfs)	39.7	36.6	28.6	9.8	13.1
Turbidity (NTU)	7.5	9.1	7.97	9.14	9.25
NH_3-N	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
NO_3/NO_2-N	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
TKN	0.43	0.44	0.45	0.57	0.51
Chloride	12.3	12.6	12.7	10.9	13.5
Total Phosphorus	0.07	0.06	0.07	0.07	0.04

Units mg/L unless otherwise noted

Spring 2005 physicochemical data for LEFMC, Locust Creek, and West Locust Creek are listed in Table 10. All parameters were similar among LEFMC stations. With the exception of stream flow, there was little difference in values between LEFMC and the two control stations. Nutrient levels were uniformly low at all stations. Ammonia-nitrogen and nitrate plus nitrite-nitrogen concentrations were below detection limits. The highest Kjeldahl nitrogen value was 0.57 mg/L at the Locust Creek control station. Total phosphorus did not exceed 0.07 mg/L at any station.

4.6 Biological Assessment

As outlined in the methods, macroinvertebrate data were evaluated by two methods. The first analysis was metric evaluation using the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (SMSBPP). The second analysis of the biological data was an evaluation of dominant macroinvertebrate family (DMF) composition.

4.6.1 Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure

The Upper East Fork Medicine Creek (UEFMC) and Lower East Fork Medicine Creek (LEFMC) metric results and MSCI scores are presented in Tables 11 through 14. The MSCI scores were calculated by scoring station metrics against the appropriate criteria in Table 1 or Table 2.

Table 11
Biocriteria Metric Scores, Macroinvertebrate Stream Condition Index Scores, and Sustainability for Upper East Fork Medicine Creek, September 2003

Station	UEFMC #1	UEFMC #2	UEFMC #2.5	UEFMC #3	UEFMC #4
Sample No.	03-18748	03-18747	03-18746	03-18745	03-18744
TR	72	62	52	41	72
EPTT	12	10	9	5	11
BI	6.43	7.17	7.44	7.21	6.52
SDI	2.85	2.19	2.48	2.36	3.01
MSCI Score	20	18	14	12	20
Sustainability	Full	Full	Partial	Partial	Full

In September 2003, Table 11 shows that UEFMC stations #1, #2, and #4 achieved full sustainability, which indicated conditions at these stations were sufficient to fully support the aquatic community. Stations #1 and #4 had the maximum MSCI score of 20 and station #2 scored 18. Stations #2.5 and #3 each had only partial sustainability. At station #2.5, which scored 14, only nine EPT taxa were found which is one less than the number needed (see Table 1) to score five, and this metric therefore scored only three. Also at this station, the SDI and BI were below the cut-off for a score of five which totaled, by adding the score of five from the total taxa metric, an MSCI score of 14. (The BI score is an inverted score; i.e., the lower the value the higher the score.) Upper East Fork Medicine Creek station #3 scored only 12 during fall 2003 (Table 11). The BI was above the cut-off for a score of five, and the other three metrics were below this value, so a score of three was calculated for each metric, giving a total MSCI score of 12.

In April 2004, all UEFMC stations were rated fully sustainable, although no station achieved a total score of 20. MSCI scores ranged from 16 to 18 among the four UEFMC stations (Table 12). Station #1 MSCI was reduced to 18 by a very low SDI score of 1.80. Stations #2 and #3 had minimum fully sustainable MSCI scores of 16. At station #2, Taxa Richness and EPT Taxa Richness were below the cut-off for a score of five. At station #3, the BI and SDI were above the cut-off for a score of five. Station #4 MSCI scored 18 because of a slightly low SDI value.

The Spring Creek BIOREF was fully sustainable with an MSCI score of 20. However, the SDI score of 2.54 was the minimum needed to score five, which is a score of > 2.53. The BI score of 7.20 was also only slightly lower than the minimum needed to score five, which is a score < 7.24.

Table 12
Biocriteria Metric Scores, Macroinvertebrate Stream Condition Index Scores, and Sustainability for Upper East Fork Medicine Creek and Spring Creek BIOREF, April 2004

Station	UEFMC #1	UEFMC #2	UEFMC #3	UEFMC #4	Spring Creek #1
Sample No.	04-18687	04-18688	04-18689	04-18690	04-18686
TR	52	50	56	60	68
EPTT	10	8	13	10	11
BI	7.21	7.15	7.40	7.08	7.20
SDI	1.80	2.56	2.04	2.37	2.54
MSCI Score	18	16	16	18	20
Sustainability	Full	Full	Full	Full	Full

Lower East Fork Medicine Creek stations sampled in September 2004 all had full sustainability and maximum MSCI scores of 20 (Table 13). This stream reach supported a diverse macroinvertebrate fauna. Total taxa among the three LEFMC stations ranged from 63 to 78. The macroinvertebrate taxa included many of the generally more sensitive EPT taxa. The three LEFMC stations had 16 to 21 EPT taxa, which was approximately twice the fall EDU BIOREF number of EPT taxa (> 9 EPT taxa) needed for a metric score of five. Each of the LEFMC stations had BI metric values well below the EDU BIOREF value of < 7.20 needed for a score of five. Shannon Diversity Index values were also high and exceeded 3.0 at each station.

Tables 13 and 14 also include metric evaluations and MSCI scores for the BIOREF stations on Locust Creek and West Locust Creek. In September, a duplicate for quality control purposes was collected at West Locust Creek. Both stations had full sustainability. However, the West Locust Creek duplicate #1b scored only 16 because of a low EPT score of nine and an SDI score of 2.63. The reason for the difference in metric scores between the duplicates may have been caused by limited macroinvertebrate habitat. It was noted during sampling that macroinvertebrate habitat was very limited because of scouring from recent flooding.

Table 13

Biocriteria Metric Scores, Macroinvertebrate Stream Condition Index Scores, and Sustainability for Lower East Fork Medicine Creek, Locust Creek BIOREF, and West Locust Creek BIOREF, September 2004

Station	LEFMC #1	LEFMC #3	LEFMC #4	Locust Creek #1	West Locust Creek #1a	West Locust Creek #1b
Sample No.	04-18757	04-18759	04-18758	04-18756	04-18761	04-18762
TR	78	72	63	61	62	54
EPTT	21	19	16	10	14	9
BI	6.45	6.21	6.58	7.05	6.73	6.62
SDI	3.21	3.35	3.12	3.06	2.91	2.63
MSCI Score	20	20	20	20	20	16
Sustainability	Full	Full	Full	Full	Full	Full

Spring 2005 macroinvertebrate samples from LEFMC all had full sustainability and had MSCI scores of 18 to 20 (Table 14). At each LEFMC station, total taxa richness, EPT taxa richness, and SDI values were lower and Biotic Index values were slightly higher in March/April 2005 compared to September 2004. However, values of each metric still exceeded the minimum spring BIOREF numbers of 51 total taxa, 8 EPT taxa, and SDI score of 2.53 needed for the maximum MSCE score of five. The Biotic Index value at each of the three LEFMC stations was slightly higher than the fall values but was still less than the BI value of 7.23 needed for the maximum MSCI score of five.

The spring Locust Creek BIOREF sample scored only 14 and was rated as partially sustainable. Total taxa, EPT taxa, and SDI values all scored slightly less than the minimum BIOREF value needed for a score of five and thus scored three for each of these metrics. When added to the BI value of five, a total MSCE score of 14 resulted. Thus, although rated as partially sustainable, three of this station's metric scores were just below the score of five cut-off and a slightly higher value of each metric would have resulted in a rating of fully sustainable and a maximum score of 20.

Table 14

Biocriteria Metric Scores, Macroinvertebrate Stream Condition Index Scores, and Sustainability for Lower East Fork Medicine Creek, Locust Creek BIOREF, and West Locust Creek BIOREF, March/April 2005

Station	LEFMC #1a	LEFMC #1b	LEFMC #3	LEFMC #4	Locust Creek #1	West Locust Creek #1
Sample No.	05-03060	05-03061	05-03062	05-03063	05-03064	05-03065
TR	65	56	57	56	51	60
EPTT	14	11	12	10	8	10
BI	6.74	6.64	6.68	6.62	6.98	6.72
SDI	2.76	2.46	2.69	2.58	2.53	2.73
MSCI Score	20	18	20	20	14	20
Sustainability	Full	Full	Full	Full	Partial	Full

4.6.2 Dominant Macroinvertebrate Families

Dominant macroinvertebrate taxa collected from Upper East Fork Medicine Creek during fall 2003 and spring 2004 are presented in Tables 15 and 16. Lower East Fork Medicine Creek dominant taxa collected during fall 2004 and spring 2005 are provided in Tables 17 and 18. Spring Creek BIOREF, Locust Creek BIOREF, and West Locust Creek BIOREF data are also presented.

Caenidae (square gilled mayflies) and Chironomidae (midge flies or chironomids) were the dominant macroinvertebrate families (DMF) at all UEFMC and LEFMC stations and the three BIOREF control stations each of the four sampling periods. The collective percent occurrence of these mayflies and chironomids exceeded 50 percent at all locations and accounted for 70 percent or more of the benthos within 17 of the 22 total samples. Following is a summary of DMF findings from Upper and Lower East Fork of Medicine Creek. Macroinvertebrate families that made up two percent or more of any composited sample each sampling period were included in the tables.

Table 15 lists UEFMC dominant families from September 2003. Caenidae, which were almost all *Caenis latipennis*, comprised from 25 to 53 percent of the macroinvertebrates. Several species of Chironomidae accounted for 19 to 39 percent of the organisms. Leptophlebiidae (prong gilled mayflies) were the third most abundant family at UEFMC stations #1 and #4 this sampling period. Other macroinvertebrate families that were dominant or common among the UEFMC stations in fall 2003 included Heptageniidae (flat headed mayflies), Baetidae (small

minnow mayflies), Hyalellidae (amphipod crustaceans), Ceratopogonidae (biting midges), Elmidae (riffle beetles), and Tubificidae (aquatic annelids).

Table15

Upper East Fork Medicine Creek Macroinvertebrate Composition and Percent Dominant Macroinvertebrate Families (DMF) per Station, September 2003

Station	UEFMC #1	UEFMC #2	UEFMC #2.5	UEFMC #3	UEFMC #4
Sample Number	03-18748	03-18747	03-18746	03-18745	03-18744
No. Total Taxa	72	62	52	41	72
No. EPT Taxa	12	10	9	5	11
% DMF; below					
Caenidae	34	53	42	44	25
Chironomidae	28	29	39	19	32
Leptophlebiidae	11	3	1	0	15
Heptageniidae	6	< 1	< 1	< 1	2
Ceratopogonidae	3	1	2	9	1
Elmidae	3	1	< 1	8	4
Leptoceridae	2	< 1	1	2	1
Baetidae	2	4	1	0	1
Coenagrionidae	2	1	4	< 1	2
Gomphidae	2	< 1	0	< 1	1
Hydropsychidae	2	< 1	0	0	0
Tubificidae	1	< 1	< 1	7	2
Physidae	< 1	2	2	1	2
Hyalellidae	< 1	4	4	0	< 1
Corixidae	< 1	< 1	< 1	2	< 1
Ephemeridae	< 1	0	1	3	1

Upper East Fork Medicine Creek macroinvertebrate data from April 2004 are presented in Table 16. Caenidae and Chironomidae collectively comprised 70 to 82 percent of the organisms among the four UEFMC stations. The Spring Creek #1 BIOREF station was also dominated by these two families, which together made up 74 percent of the benthos. Simuliidae (black flies) were common at several stations and made up 12 percent of the UEFMC composite sample. Other common macroinvertebrates found in the spring 2004 samples included Perlidae (perlid stoneflies) and amphipods.

Table 16
Upper East Fork Medicine Creek and Spring Creek BIOREF Macroinvertebrate Composition and Percent Dominant Macroinvertebrate Families (DMF) per Station, April 2004

Station	UEFMC #1	UEFMC #2	UEFMC #3	UEFMC #4	Spring Creek #1
Sample Number	04-18687	04-18688	04-18689	04-18690	04-19686
No. Total Taxa	52	50	56	60	68
No. EPT Taxa	10	8	13	10	11
% DMF; below					
Caenidae	65	37	54	43	45
Chironomidae	17	33	27	37	29
Simuliidae	4	12	3	2	< 1
Perlidae	2	1	< 1	3	4
Gomphidae	2	2	< 1	1	1
Enchytraeidae	1	3	3	2	3
Hyalellidae	1	< 1	3	4	2
Tubificidae	0	2	1	< 1	2
Elmidae	< 1	< 1	2	1	< 1
Tipulidae	0	< 1	< 1	< 1	2
Corixidae	< 1	< 1	< 1	0	2

Dominant macroinvertebrate family data for Lower East Fork Medicine Creek from September 2004 are presented in Table17. Caenidae and Chironomidae were the dominant families. However, unlike nearly all UEFMC samples, chironomids made up a larger proportion of the LEFMC samples. Chironomidae percent occurrence in September 2004 samples ranged from 49 to 62 percent among the three LEFMC stations and chironomids constituted 60 to 69 percent of the benthos among the control samples.

The three LEFMC samples from fall 2004 also contained a high number of EPT taxa and more EPT taxa than were found in the BIOREF control samples. Several EPT families, in addition to Caenidae, also comprised several of the dominant LEFMC families. These included the mayfly families Leptophlebiidae, Heptageniidae and Baetidae. With the exception of Hydopsychidae in West Locust Creek samples, EPT taxa other than Caenidae were not dominant within the control samples.

Table 18 provides DMF data for LEFMC and control samples collected in March/April 2005. Chirionimidae made up a very large proportion of each LEFMC and control sample. Percent occurrence of Chironomidae within spring 2005 LEFMC samples was 86 to 90 percent and chironomids made up 90 percent of Locust Creek BIOREF organisms and 76 percent of the West Locust Creek BIOREF benthos. In addition to Caenidae, three EPT families made up one percent or more of nearly all LEFMC spring samples.

Table 17
Lower East Fork Medicine Creek, Locust Creek BIOREF, and West Locust Creek BIOREF Macroinvertebrate Composition and Percent Dominant Macroinvertebrate Families (DMF) per Station, September 2004

Station	LEFMC #1	LEFMC #3	LEFMC #4	Locust Creek #1	West Locust Creek #1a	West Locust Creek #1b
Sample Number	04-18757	04-18759	04-18758	04-18756	04-18761	04-18762
No. Total Taxa	78	72	63	61	62	54
No. EPT Taxa	21	19	16	10	14	9
% DMF; below						
Chironomidae	54	49	62	60	66	69
Caenidae	10	13	12	18	15	12
Leptophlebiidae	9	9	8	3	3	2
Heptageniidae	6	5	4	1	2	1
Baetidae	4	4	2	1	1	1
Leptohyphidae	2	2	< 1	0	0	0
Leptoceridae	2	1	1	0	1	< 1
Hyalellidae	< 1	2	4	9	2	2
Hydropsychidae	1	2	0	< 1	4	5
Simuliidae	1	2	0	0	0	< 1
Ceratopogonidae	< 1	2	< 1	2	0	< 1
Elmidae	1	< 1	2	0	2	1
Coenagrionlidae	< 1	1	2	2	1	< 1

Table18
Lower East Fork Medicine Creek, Locust Creek BIOREF, and West Locust Creek BIOREF Macroinvertebrate Composition and Percent Dominant Macroinvertebrate Families (DMF) per Station, March/April 2005

Station	LEFMC #1a	LEFMC #1b	LEFMC #3	LEFMC #4	Locust Creek #1	West Locust Creek #1
Sample Number	05-03060	05-03061	05-03062	05-03063	05-03064	05-03065
No. Total Taxa	65	56	57	56	51	60
No. EPT Taxa	14	11	12	10	8	10
% DMF; below						
Chironomidae	86	88	84	85	90	76
Caenidae	2	2	4	4	4	10
Heptageniidae	3	2	3	1	1	1
Baetidae	2	4	4	5	< 1	3
Hydropsychidae	2	1	1	< 1	2	1
Simuliidae	< 1	< 1	< 1	< 1	< 1	3

5.0 Discussion

5.1 Land Use

East Fork Medicine Creek land use fairly well matched the land use of the Plains/Grand/Chariton EDU. In comparison to three BIOREF streams within the EDU, there was more than twice as much land in row crops at all EFMC stations, with the exception of the two furthest upstream stations, UEFMC #3 and #4. These findings indicate that EFMC stream quality may be expected to be somewhat degraded compared to reference watersheds.

5.2 Habitat Assessment

Habitat assessments were conducted on UEFMC and LEFMC in September 2003 and September 2004, respectively. During the two-year span of the study, significant flooding impacted the stream in late winter/early spring 2004 and again in late summer 2004. The habitat assessment of UEFMC was conducted in fall 2003 during a stable period of low flow conditions. Lower East Fork Medicine Creek habitat assessment was done in fall 2004 following late summer flooding, soon after the stream and its banks had been substantially disrupted by flood waters. Because of the timing of the flood events, the UEFMC scored higher on habitat assessment than did LEFMC. For example, in fall 2003, all four UEFMC stations had habitat scores that were 95 percent or more of the West Locust Creek BIOREF. In contrast to UEFMC, all three LEFMC stations had lower, but still comparable, habitat assessment scores because of degraded conditions caused by flooding. Stream habitat at LEFMC then improved considerably by the time of spring 2005 sampling.

5.3 Sinuosity and Riparian Zone Condition

The overall SHAPP of East Fork Medicine Creek indicated good habitat conditions at EFMC in September 2003, and mostly fair habitat conditions at LEFMC in September 2004, following late summer flooding. Two components of SHAPP, sinuosity and riparian zone condition, are not affected by common flood events. Upper East Fork Medicine Creek had a mostly straight channel, with UEFMC #1 obviously channelized and the remaining three stations probably channelized. Riparian zone condition at UEFMC ranged from fair to good. Lower East Fork Medicine Creek was obviously channelized, with a riparian zone that was rated fair to very good. An overview of sustainability for EFMC provided in Tables 11 through 14 shows no relationship between sinuosity and riparian zone condition and sustainability. Nearly all EFMC stations had full sustainability regardless of sinuosity or riparian zone condition.

5.4 Stream Width and Depth Measurements

Upper East Fork Medicine Creek channel width to wetted width ratios were considerably higher than the Plains/Grand/Chariton BIOREF mean value of 1.6 at downstream UEFMC stations #1 and #2 (Table 6). At upstream UEFMC stations #3 and #4, this ratio was lower than the BIOREF value. The higher ratios at the downstream stations indicated the stream had a rather narrow width compared to its channel width as one proceeds downstream. This commonly occurs in streams that undergo rapidly increasing stream stage and flows (often termed “flashy” streams) that are poorly confined by easily eroded stream banks. Lower East Fork Medicine Creek channel width to wetted width ratios were similar to and somewhat less than the BIOREF

values. This would normally indicate improved stream morphology downstream. However, LEFMC was assessed a few weeks following a large flood event and the stream had not quite returned to low flow conditions. Had drier weather prevailed, LEFMC channel width to wetted width ratios would probably have been higher and similar to the ratios at UEFMC stations #1 and #2.

Wetted width to depth ratios exceeded the Plains/Grand/Chariton BIOREF stream values at all stations except UEFWC #2. There was no obvious trend in changes in this ratio from upstream to downstream. In general, the data showed that EFMC was wider and shallower than the BIOREF streams, but stream morphology varied considerably among stations.

5.5 Physicochemical Data

The water quality of East Fork Medicine Creek was fairly good. Initial sampling of UEFMC commenced in September 2003 following a recent rain. Sampling began at the furthest upstream station, UEFMC #4, in order to allow the stream stage to drop as sampling progressed downstream. Because of runoff of water from row-cropped fields, UEFMC was quite turbid; turbidity readings were fairly high and ranged from 79.8 NTU at station #1 to 187 NTU at station #4 (Table 7). Three other parameters, chloride, total Kjeldahl nitrogen, and total phosphorus, were elevated at UEFMC #4 in September. Chloride was 18 mg/L, total Kjeldahl nitrogen was 2.27 mg/L, and total phosphorus was an extremely high 7.57 mg/L. No source or cause of the very high total phosphorus could be found, other than it was likely that the phosphorus was delivered in either surface runoff or groundwater following the rain event. Although there are no large confined animal feeding operations (CAFOs) on UEFMC, there are several a few miles west on tributaries to Upper West Fork Medicine Creek **(UWFMC)** and there might be land application of wastewater from these CAFOs in the UEFMC watershed. Turbidity, chloride, total Kjeldahl nitrogen, and especially total phosphorus declined downstream in fall 2003, but remained somewhat elevated.

April 2004 UEFMC physicochemical results (Table 8) were notable for several changes in parameter values compared to September 2003 data. Levels of total phosphorus were lower at each station compared to fall 2003. Station #4 total phosphorus levels, although still elevated, had dropped to 0.21 mg/L and the concentrations of total phosphorus were similar among the four stations. Nitrate plus nitrite-nitrogen concentrations increased from fall to spring at UEFMC #1, #2, and #3 and decreased at UEFMC #4. Levels of this nutrient increased from upstream to downstream and ranged from 0.34 mg/L at furthest upstream UEFMC #4 to 0.61 mg/L at UEFMC #1. Concentrations of nutrients often are somewhat higher in spring and usually reflect higher stream flows and often, application of fertilizer to farm fields. Stream discharge was higher in the spring and ranged from 7.37 cfs at UEFMC #4 to 50.0 cfs at UEFMC #1. The Spring Creek BIOREF water sample contained very low concentrations of ammonia, nitrate plus nitrite-nitrogen, and total phosphorus. This likely was because of the greater amount of forest cover and much less row cropping in the BIOREF catchment.

Lower East Fork Medicine Creek physicochemical samples (Tables 9 and 10) had low levels of all nutrient parameters in fall 2004 and spring 2005. Levels of ammonia-nitrogen and nitrate plus nitrite-nitrogen were below detection limits at the three LEFMC stations each sampling

period. The highest total phosphorus values each season were 0.10 mg/L at LEFMC #1 in September 2004 and 0.07 mg/L at LEFMC #1 and #3 in April 2005. Total Kjeldahl nitrogen concentrations were not elevated and five of the six samples from the three LEFMC stations over the two sampling periods were less than 0.05 mg/L. There were no unusual values of any other measured parameter at LEFMC either sampling season.

5.6 Biological Data

This discussion section is separated into Upper and Lower East Fork Medicine Creek sustainability comparisons followed by a short discussion of flooding impacts on the macroinvertebrate assemblage.

5.6.1 Upper East Fork Medicine Creek

5.6.1.1 September 2003

Two of five UEFMC stations achieved only partial sustainability in September 2003. Stations #2.5 and #3 scored only 12, and an MSCI score of 16 is required for minimal full sustainability. Nearly all metrics at each station scored slightly or somewhat below the 25th percentile (or above the 75th percentile for the inverted Biotic Index metric) needed for a score of five. The reason for the low MSCI scores at stations #2.5 and #3 was lack of macroinvertebrate habitat. The two stations comprised stream reaches influenced by beavers. Each station consisted of a recently formed pool located upstream from a beaver dam. Station #2.5 did not have root-mat habitat and station #3 lacked root-mat and woody debris habitats. Lack of habitats combined with disruption of the stream bottom from beaver activity likely caused partial sustainability at each station.

5.6.1.2 April 2004

In April 2004, UEFMC had full sustainability at each station, although none of the four stations scored the maximum MSCI score of 20. Station #1 scored 18 because of a very low SDI of 1.80, which resulted in a score of three for this metric. The low SDI score occurred because 65 percent of the sample was composed of a single taxon, the mayfly *Caenis latipennis*. A very large abundance of any single taxon will lower the SDI value.

Stations #2 and #3 had minimum full sustainability and MSCI scores of 16. At station #2, taxa richness and EPT taxa richness were slightly fewer than the number required to score five; i.e., below the 75th percentile, and at station #3 the Biotic Index value was too high and the SDI too low to score five. A slightly lowered SDI at station #4 resulted in an MSCI score of 18 for this station. There was no obvious cause for the lowered MSCI scores at stations #2, #3, and #4. Habitat disruption from late winter flooding probably was an important factor. It was noted during spring sampling of UEFMC that all beaver dams had largely been swept away by high flows that occurred a few weeks before sampling. Also, non-flow habitat was judged very poor at all stations because of eroded substrates and lack of organic matter.

5.6.2 Lower East Fork Medicine Creek

5.6.2.1 September 2004

Macroinvertebrate data indicated that LEFMC was unimpaired. Lower East Fork Medicine Creek had full sustainability in fall 2004 and each of the three stations had maximum MSCI scores of 20. The fall 2004 samples were notable for the high number of EPT taxa, which averaged between 18 and 19 among the three stations. Ten or more EPT taxa are required for a maximum metric score of five for fall glide/pool BIOREF samples from the Plains/Grand/Chariton EDU. The large number of EPT taxa was somewhat surprising, given that mainstem Medicine Creek had high flood waters a few weeks before fall sampling.

5.6.2.2 March/April 2005

Metric scores in spring 2005 at LEFMC were lower than in fall 2004. However, all metric values at each station exceeded the criteria for an MSCI score of 20, except duplicate sample #1b, which totaled 18. Spring sampling at LEFMC also had been preceded by significant flooding on mainstem Medicine Creek in late winter. As in the fall, the flooding was not severe enough to impair the macroinvertebrate assemblage sustainability of the LEFMC stations.

5.6.3 Flooding Impacts on East Fork Medicine Creek

The potential impact of flooding on the East Fork Medicine Creek macroinvertebrate assemblage was examined by a review of stream stage and flow at a nearby United States Geological Survey (USGS) gaging station. The USGS operates a gaging station on mainstem Medicine Creek near Laredo, Missouri, approximately six miles downstream from the confluence of East Fork Medicine Creek and West Fork Medicine Creek. Average daily stream stage and discharge were analyzed for Medicine Creek over the two-year study period. There were two flood events prior to sampling. The first flood occurred in early March 2004 about one month before sampling began the first week of April at UEFMC. Over a two-day span from March 3 to March 5, stream stage increased from about three feet to 14.5 feet, and discharge increased from roughly 65 cfs to nearly 8000 cfs. Stream stage and discharge then rapidly declined to near ambient levels. The second event occurred in late August 2004 about three weeks before fall sampling began on LEFMC. Stream stage and discharge rapidly increased from summer minimums to a stage of 19.5 feet and a discharge of 18,500 cfs on August 28. The values then dropped back to near ambient levels before sampling commenced.

Macroinvertebrate data from UEFMC following the first flood event in spring 2004 did not indicate obvious impairment of the benthos. There was a slight decline of MSCI scores at stations #1, #2, and #4. However, the station #3 MSCI score increased from 12 to 16 from spring to fall, probably because flooding removed a large beaver dam and increased the number of habitats available for sampling from one in the fall to three in the spring. Also, all four stations were rated fully sustainable, albeit with reduced MSCI scores at three of the stations. The full sustainability of UEFMC during spring 2004 following late winter flooding contrasts somewhat with results from nearby UWFMC spring 2004 macroinvertebrate data (MDNR, 2006). In April 2004 at UWFMC, MSCI scores were lower at two of four stations compared to fall 2003 and the two stations were rated partially sustainable. The remaining two stations had the same MSCI score of 16 as in the fall and were minimally fully sustainable. To summarize,

the late winter flooding seemed to impact UWFMC more than UEFMC, but the benthos of neither stream was severely impacted. There was no apparent impairment of the LEFMC macroinvertebrate community in fall 2004 following the second flood event in late August 2004, even though this flood event was larger than in the spring and occurred about three weeks before sampling began. The three LEFMC stations had full sustainability and MSCI scores of 20. Lower West Fork Medicine Creek **(LWFMC)** also had full sustainability and MSCI scores of 20 at all five stations in fall 2004 (MDNR, 2006). It is unclear why the spring 2004 flood seemed to have more of an impact on UEFMC and UWFMC macroinvertebrate faunas while the faunas of LEFMC and LWFMC apparently were not impaired by late summer flooding. Perhaps flooding had a slightly greater impact on near headwater stream reaches while lower stream reaches were large enough to assimilate flooding without experiencing a severe impact on the macroinvertebrate fauna. Colonization from upstream obviously becomes less likely the further upstream is the stream reach. Also, late winter flooding may have greater impact on the invertebrate fauna compared to late summer because of greatly reduced recruitment from reproduction and very little upstream aerial migration of aquatic insects in winter.

An interesting aspect of the fall 2004 flooding was the effect of the flood on the dominance of Chironomidae and Caenidae. Chironomidae usually comprise a larger proportion of the benthos in Plains/Grand/Chariton EDU BIOREF streams than is made up by Caenidae. At UEFMC, Caenidae was dominant in fall 2003 and spring 2004 at all stations, both seasons, except furthest upstream UEFMC #4, in September 2003. Lower East Fork Medicine Creek was sampled a few weeks following the large flood event in August 2004. Chironomidae was the dominant family at all LEFMC stations and BIOREF stations in September 2004. The dominance of Chironomidae was even greater in spring 2005 at all stations. The proportion of Chironomidae increased substantially from fall 2004 to spring 2005, while the fraction of Caenidae decreased. This occurred at all LEFMC and BIOREF stations. In September 2004, percent Chironomidae averaged 55 percent among the three LEFMC stations and in March 2005 Chironomidae averaged 86 percent of the LEFMC organisms at these stations. The figures for Caenidae were an average of 12 percent in fall 2004 and three percent in spring 2005.

The change in dominance from Caenidae to Chironomidae is probably a common phenomenon following significant flooding. A very similar change in dominance from Caenidae to Chironomidae was also found at adjacent West Fork Medicine Creek (MDNR, 2006). The caenids were probably largely swept downstream in late August and would not have been able to recolonize between fall and spring sampling, so their numbers continued to decline. Many Chironomidae have short life cycles and are often early colonizers following flooding. Rapid recolonization by Chironomidae probably resulted in a high proportion of this family the following spring.

5.7 East Fork Medicine Creek Stream Segment

The overall bioassessment of the East Fork Medicine Creek stream segment covered by this study suggests little biological impairment. Upper East Fork Medicine Creek stations #2.5 and #3 had partial sustainability in September 2003 as a result of beaver activity. All other UEFMC stations and all LEFMC stations had full sustainability each sampling period.

Macroinvertebrates have been shown to have good relationships to amounts of depositional sediment (Zweig and Rabeni 2001) in rock bottomed streams. However, northern Missouri streams are largely composed of materials considered to be sediment (silt and sand) by many researchers. As in many northern Missouri reference streams, the bottom substrate of East Fork Medicine Creek is predominantly sand. The results of this study suggest that EFMC macroinvertebrate communities are very similar to reference streams.

Although macroinvertebrates are responsive to changes in substrate, they may not be responsive to certain habitat problems such as uniformly shallow stream depths and past channelization. East Fork Medicine Creek shows evidence of channelization and resultant shallow water depths. This evidence includes severe habitat disruption from flooding and low sinuosity at most stations. Channel width to wetted width ratios and wetted width to depth ratios were similar to, or at least did not greatly exceed, BIOREF values at several stations. However, this was largely because stream stage of LEFMC was slightly elevated during habitat assessment. During dry weather it is likely that values of these two ratios would have been much greater than the BIOREF values, and this would indicate a wider, shallower stream than the bioassessment data show.

The lack of top predator fish has been shown to have a good relationship to channelized streams and resultant lack of pools (MDNR 2005). No top predator game fish such as bass or channel catfish were seen in the entire EFMC study reach. In general, the stream lacked adequate pools and is likely too shallow during low flow conditions to support top predators such as game fish.

6.0 Conclusions

This report's null hypotheses stated: 1) Habitat quality, water quality, and macroinvertebrate assemblages are similar among East Fork Medicine Creek stream segments; and 2) habitat quality, water quality, and macroinvertebrate assemblages are similar between East Fork Medicine Creek and biocriteria (BIOREF) streams within the Plains/Grand/Chariton Ecological Drainage Unit (EDU).

Null hypothesis #1 is largely accepted. Habitat quality of two stations, Upper East Fork Medicine Creek (UEFMC) #2.5 and #3, were dissimilar to UEFMC stations #1, #2, and #4 in September 2003 because stations #2.5 and #3 were temporarily ponded by beaver dams.

Water quality was comparable among the four UEFMC stations, except UEFMC #4 in September 2003, where a high concentration of total phosphorus was recorded. Water quality was comparable among the three Lower East Fork Medicine Creek (LEFMC) stations.

Macroinvertebrate communities were similar, within each sampling season, among nearly all UEFMC and LEFMC stations. Two of five UEFMC stations (UEFMC #2.5 and #3) in September 2003 achieved only partial sustainability because of limited habitat caused by beaver dams.

Null hypothesis #2 is largely accepted. Habitat quality of LEFMC #3 and #4 in fall 2004 was slightly impaired due to flooding a few weeks earlier. Both stations, however, exceeded 75

percent similarity of the West Locust Creek BIOREF and were therefore comparable to the reference station.

Water quality of East Fork Medicine Creek was generally comparable to the BIOREF, with the exception of high levels of total phosphorus found in UEFMC #4 in September 2003.

Macroinvertebrate Stream Condition Index (MSCI) scores of EFMC were similar to the Spring Creek BIOREF and West Locust Creek BIOREF MSCI scores each sampling season, with the exception of partial sustainability recorded at stations #2.5 and #3 in September 2003.

The mayfly family, Caenidae, and the midge fly family, Chironomidae, were the dominant macroinvertebrate families at EFMC. Caenidae, which were nearly all *Caenis latipennis*, comprised the majority of organisms at nearly all UEFMC stations in fall 2003 and spring 2004. Chironomidae was the dominant family at LWFMC in fall 2004 and spring 2005. Severe flooding of the stream in late August 2004 probably caused the shift in dominance from Caenidae to Chironomidae, greatly reducing the numbers of *C. latipennis*.

7.0 Recommendation

Conduct in-depth assessments of channelized streams to determine overall stream health or stream quality. The assessments should include 1) water quality, 2) stream hydrology, including water quantity and pool structure, 3) evaluation of the fish, and 4) more detailed habitat assessments (e.g., USGS National Water Quality Assessment or U.S. EPA Environmental Monitoring and Assessment Program protocols).

8.0 Literature Cited

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Appendix A

Macroinvertebrate Bench Sheets
for
East Fork Medicine Creek, Locust Creek, and West Locust Creek
Fall 2003-Spring 2005

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0318744], Station #4, Sample Date: 9/23/2003 12:30:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
"HYDRACARINA"			
Acarina	2	4	
AMPHIPODA			
Hyalella azteca	1	1	2
COLEOPTERA			
Agabus		1	
Chaetarthria			1
Dubiraphia	23	15	1
Helichus lithophilus		4	3
Hydroporus	1		
Paracymus		2	
Scirtes		23	17
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia	19	6	4
Anopheles		1	
Axarus	1		
Ceratopogoninae	8	1	1
Chaoborus	1		
Chironomus	17		
Chrysops	1		
Corynoneura	3		3
Cricotopus/Orthocladius		1	
Cryptochironomus	5		
Dicrotendipes		1	37
Endochironomus	1		
Ephydridae	3		
Forcipomyiinae	1		2
Glyptotendipes	8	6	63
Labrundinia	4	10	1
Nanocladius		2	3
Parachironomus	1	1	
Parakiefferiella			1
Paratanytarsus	4	4	4
Polypedilum convictum grp			2
Polypedilum fallax grp			1
Polypedilum halterale grp			1

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0318744], Station #4, Sample Date: 9/23/2003 12:30:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
Polypedilum illinoense grp	3	2	7
Procladius	12		
Rheotanytarsus		2	
Stempellinella			1
Stenochironomus	1		9
Tabanidae		2	
Tanytarsus	19	12	16
Thienemannimyia grp.		1	1
Tribelos		2	2
undescribed Empididae		1	
EPHEMEROPTERA			
Acerpenna		1	
Caenis hilaris	1		
Caenis latipennis	141	80	14
Callibaetis	2		
Hexagenia limbata	6	1	
Leptophlebiidae	35	80	29
Paracloeodes	2	5	1
Procloeon		2	
Stenacron	6	10	7
HEMIPTERA			
Belostoma			-99
Corixidae	2		
Metrobates	1		
Microvelia		6	
LIMNOPHILA			
Ancylidae	3		
Fossaria	2	2	
Physella	19	3	
MEGALOPTERA			
Sialis	1		
ODONATA			
Argia	1	6	8
Boyeria		-99	
Enallagma	2	3	
Hetaerina		2	
Libellula	1		
Progomphus obscurus	4	3	

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0318744], Station #4, Sample Date: 9/23/2003 12:30:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
TRICHOPTERA			
Phryganeidae	2	1	
Triaenodes		7	
TUBIFICIDA			
Aulodrilus	5		
Tubificidae	11	5	1
UNIONIDA			
Unionidae		1	
VENEROIDEA			
Sphaeriidae	-99	2	-99

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0318745], Station #3, Sample Date: 9/24/2003 10:30:00 AM

NF = Nonflow

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF
"HYDRACARINA"	
Acarina	1
COLEOPTERA	
Dubiraphia	19
Hydroporus	1
DIPTERA	
Ceratopogoninae	23
Chaoborus	1
Chironomus	2
Cladotanytarsus	5
Constempellina	1
Cricotopus/Orthocladius	1
Cryptochironomus	3
Cryptotendipes	1
Dicrotendipes	1
Empididae	1
Nanocladius	2
Ormosia	2
Paratendipes	1
Phaenopsectra	1
Polypedilum halterale grp	1
Procladius	10
Pseudochironomus	1
Stempellinella	2
Tanypus	5
Tanytarsus	11
EPHEMEROPTERA	
Caenis latipennis	109
Hexagenia limbata	7
Stenacron	1
HEMIPTERA	
Corixidae	4
LIMNOPHILA	
Fossaria	1
Menetus	1

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0318745], Station #3, Sample Date: 9/24/2003 10:30:00 AM	
NF = Nonflow	
A value of -99 indicates that the species was found, but the exact number of species was not determined.	
ORDER: TAXA	**NF**
Physella	2
ODONATA	
Argia	1
Gomphidae	1
Gomphus	-99
Libellulidae	1
Progomphus obscurus	-99
TRICHOPTERA	
Nectopsyche	2
Oecetis	3
TUBIFICIDA	
Aulodrilus	1
Tubificidae	16
UNIONIDA	
Unionidae	1
VENEROIDEA	
Sphaeriidae	2

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0318746], Station #2.5, Sample Date: 9/24/2003 3:00:00 PM		
NF = Nonflow, SG = Woody Debris		
A value of -99 indicates that the species was found, but the exact number of species was not determined.		
ORDER: TAXA	**NF**	**SG**
"HYDRACARINA"		
Acarina		1
AMPHIPODA		
Hyalella azteca		25
COLEOPTERA		
Berosus	1	2
Chaetarthria		1
Dubiraphia	1	
Hydrochus		1
Hydroporus		-99
Scirtes		1
DIPTERA		
Ablabesmyia	3	1
Ceratopogoninae	14	
Chaoborus	4	
Cladotanytarsus	21	
Constempellina	2	
Cricotopus bicinctus		1
Cricotopus/Orthocladius		1
Cryptochironomus	7	
Cryptotendipes	1	
Dasyheleinae	1	
Dicrotendipes	6	47
Endochironomus		7
Forcipomyiinae		2
Glyptotendipes	10	55
Labrundinia		1
Nanocladius	1	1
Parachironomus		1
Parakiefferiella	4	
Paratanytarsus		1
Pericoma	1	
Phaenopsectra	1	
Polypedilum		1
Polypedilum halterale grp	4	
Polypedilum illinoense grp	1	9
Procladius	15	

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0318746], Station #2.5, Sample Date: 9/24/2003 3:00:00 PM

NF = Nonflow, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	SG
Stelechomyia		1
Stempellinella	7	
Tanypus	6	
Tanytarsus	19	21
EPHEMEROPTERA		
Caenis hilaris	1	
Caenis latipennis	160	112
Hexagenia limbata	7	
Leptophlebiidae		5
Paracloeodes		4
Procloeon	5	
Stenacron	1	
HEMIPTERA		
Corixidae	1	
LIMNOPHILA		
Physella		12
ODONATA		
Argia	1	18
Enallagma	4	
TRICHOPTERA		
Hydroptila	2	
Oecetis	7	2
TUBIFICIDA		
Tubificidae	3	
VENEROIDEA		
Sphaeriidae	1	

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0318747], Station #2, Sample Date: 9/24/2003 4:15:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
"HYDRACARINA"			
Acarina	7	2	
COLEOPTERA			
Agabus	2		
Berosus	1		
Dubiraphia	6	4	
Enochrus		1	
Gyretes		2	
Helichus lithophilus		1	3
Hydroporus	2	2	
Scirtes		4	
Tropisternus		1	
DIPTERA			
Ablabesmyia	8		
Ceratopogoninae	3	1	
Chironomus	3	1	
Cladotanytarsus	5		1
Corynoneura		1	
Cricotopus bicinctus			1
Cricotopus/Orthocladius			11
Cryptochironomus	1		
Dicrotendipes		6	77
Diptera	1		
Forcipomyiinae	3		
Glyptotendipes	3	20	8
Labrundinia	6	8	
Limonia	1		
Nanocladius	1		
Paratanytarsus		2	1
Pericoma	2		
Polypedilum		1	
Polypedilum halterale grp	2		
Polypedilum illinoense grp	2	2	1
Procladius	5		
Rheotanytarsus		3	1
Simulium			2
Stempellinella	10	1	

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0318747], Station #2, Sample Date: 9/24/2003 4:15:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
Tanytarsus	9	9	27
Thienemannimyia grp.		3	
Zavrelimyia		1	1
EPHEMEROPTERA			
Brachycercus	1		
Caenis latipennis	112	174	160
Leptophlebiidae	3	22	1
Paracloeodes	1	3	19
Procloeon	10		
Stenacron		1	3
Stenonema femoratum			1
HEMIPTERA			
Corixidae	2		
Pelocoris		-99	
Trepobates	2		
LIMNOPHILA			
Physella	2	6	
LUMBRICULIDA			
Lumbriculidae		1	
MEGALOPTERA			
Corydalus			1
ODONATA			
Argia		3	
Boyeria		-99	
Enallagma	2	2	
Gomphus		-99	
Progomphus obscurus	2		
TRICHOPTERA			
Cheumatopsyche			1
Hydroptila			2
Nectopsyche		4	
TUBIFICIDA			
Enchytraeidae		1	
Tubificidae	4	1	
UNIONIDA			
Unionidae		-99	
VENEROIDEA			

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0318747], Station #2, Sample Date: 9/24/2003 4:15:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
Sphaeriidae	2		

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0318748], Station #1, Sample Date: 9/25/2003 11:00:00 AM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
AMPHIPODA			
Hyalella azteca		2	
COLEOPTERA			
Berosus	1		1
Dubiraphia	18	9	1
Helichus lithophilus	2	5	5
Hydroporus	2	1	
Paracymus			2
Scirtes	1		2
Tropisternus		-99	1
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia	4	1	
Ceratopogoninae	8	2	
Chaoborus	2		
Chironomus	8		
Cladotanytarsus	3	1	
Corynoneura		1	1
Cricotopus bicinctus	1	1	4
Cricotopus/Orthocladius			10
Cryptochironomus	2		
Dicrotendipes	3	1	70
Dolichopodidae	2		
Forcipomyiinae	7	2	10
Glyptotendipes	2		10
Gonomyia	1		
Hemerodromia			1
Labrundinia	1	12	
Nanocladius		8	2
Ormosia	1		1
Parachironomus		2	
Paracladopelma	2		
Polypedilum convictum grp			2
Polypedilum halterale grp	1		1
Polypedilum illinoense grp	2		5
Procladius	12		

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0318748], Station #1, Sample Date: 9/25/2003 11:00:00 AM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
Rheotanytarsus		8	6
Simulium			1
Stelechomyia			1
Stempellina	2		
Stempellinella	2	5	
Stenochironomus			23
Tanypus	1		
Tanytarsus	14	18	21
Thienemanniella			1
Thienemannimyia grp.		4	10
EPHEMEROPTERA			
Caenis hilaris	3	1	
Caenis latipennis	144	136	69
Hexagenia limbata	6		
Leptophlebiidae	10	101	4
Paracloeodes	4	4	12
Stenacron	4		9
Stenonema terminatum			47
HEMIPTERA			
Corixidae	3		
Microvelia		1	
Pelocoris		-99	
Rhagovelia	1		
LIMNOPHILA			
Physella		-99	
MEGALOPTERA			
Corydalus		-99	1
Sialis	-99	-99	-99
ODONATA			
Argia		18	2
Boyeria		-99	
Gomphus	12	1	1
Hetaerina		-99	
Libellulidae	1		
Macromia		-99	
Progomphus obscurus	3	-99	-99
PLECOPTERA			
Perlidae			1

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0318748], Station #1, Sample Date: 9/25/2003 11:00:00 AM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
TRICHOPTERA			
Cheumatopsyche		1	15
Hydroptila			2
Nectopsyche	5	18	1
Phryganeidae		1	
TUBIFICIDA			
Aulodrilus		1	
Tubificidae	7	2	1
VENEROIDEA			
Sphaeriidae	1	1	2

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0418687], Station #1, Sample Date: 4/5/2004 5:15:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
"HYDRACARINA"			
Acarina	7	1	1
AMPHIPODA			
Hyalella azteca	4	1	
COLEOPTERA			
Dubiraphia	2		
Helichus lithophilus		4	
Hydroporus	1	4	
Laccophilus	1		
Peltodytes	3	1	
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia	4	1	
Ceratopogoninae	1		
Cladotanytarsus	5		
Cnephia		3	33
Corynoneura		2	
Cricotopus bicinctus	2	5	14
Cricotopus/Orthocladius		6	16
Dicrotendipes	2	1	25
Endochironomus		1	
Glyptotendipes		2	1
Hydrobaenus	1	5	
Labrundinia	3	2	
Mesosmittia	1		
Nanocladius	1	4	1
Paratanytarsus		4	1
Paratendipes	1		
Phaenopsectra		1	
Polypedilum convictum grp			3
Polypedilum illinoense grp	1		1
Procladius	1		
Rheotanytarsus			1
Saetheria			1
Tanytarsus	4	5	7
Thienemanniella			1

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0418687], Station #1, Sample Date: 4/5/2004 5:15:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
Thienemannimyia grp.		3	
Zavrelimyia	1		
EPHEMEROPTERA			
Acerpenna		1	
Baetisca lacustris	2		1
Caenis latipennis	193	304	32
Hexagenia limbata	-99		
Leptophlebia	4	7	
Leptophlebiidae		1	
Stenacron	1	3	1
Stenonema terminatum			1
HEMIPTERA			
Belostoma		-99	
Sigara	4		
ODONATA			
Argia		1	
Enallagma	4		
Gomphus	1		
Progomphus obscurus	12		
PLECOPTERA			
Perlesta		12	1
TRICHOPTERA			
Nectopsyche		2	
TUBIFICIDA			
Enchytraeidae	1	5	2
VENEROIDEA			
Sphaeriidae	6	1	

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0418688], Station #2, Sample Date: 4/6/2004 9:00:00 AM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
"HYDRACARINA"			
Acarina	1		
AMPHIPODA			
Hyalella azteca		1	
COLEOPTERA			
Berosus	1		
Dubiraphia	1	1	
Helichus lithophilus		3	
Paracymus	1		
DECAPODA			
Orconectes immunis		1	
DIPTERA			
Ablabesmyia	2		
Ceratopogoninae	4	2	
Cladotanytarsus	4		
Cricotopus bicinctus	1	18	13
Cricotopus/Orthocladius	1	13	14
Dicrotendipes		1	40
Diplocladius		1	
Glyptotendipes	1	1	2
Hydrobaenus	2	12	4
Labrundinia	1	1	
Ormosia	3		
Parametriocnemus	1	1	
Paraphaenocladius	1		
Paratanytarsus	1	1	1
Phaenopsectra	3		
Polypedilum convictum grp	1	4	1
Polypedilum illinoense grp	2	2	2
Polypedilum scalaenum grp	1		
Procladius	2		
Simulium		25	36
Tabanus	1		
Tanytarsus	2	10	
EPHEMEROPTERA			
Acerpenna		6	
Baetisca lacustris		1	

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0418688], Station #2, Sample Date: 4/6/2004 9:00:00 AM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
Caenis latipennis	42	143	5
Leptophlebia	1	6	
Stenacron	2		1
HEMIPTERA			
Corixidae	1		
MEGALOPTERA			
Chauliodes rastricornis			1
Corydalus		-99	
ODONATA			
Argia	2		
Enallagma		1	
Gomphus	1		
Libellula	1		
Progomphus obscurus	6	1	
PLECOPTERA			
Perlesta		4	
TRICHOPTERA			
Nectopsyche		3	
Ptilostomis		1	
TUBIFICIDA			
Enchytraeidae	2	13	
Limnodrilus claparedianus	1		
Limnodrilus hoffmeisteri	2	2	
Tubificidae	1	6	
VENEROIDEA			
Sphaeriidae	2		

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0418689], Station #3, Sample Date: 4/6/2004 12:00:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
"HYDRACARINA"			
Acarina	1	2	
AMPHIPODA			
Hyalella azteca	8	20	4
COLEOPTERA			
Dubiraphia	9	9	
Helichus lithophilus		3	
Hydroporus	1	6	
Peltodytes	3	2	
DECAPODA			
Orconectes immunis		1	
Orconectes virilis		1	
DIPTERA			
Ceratopogoninae	3	3	1
Chironomus	1		
Cricotopus bicinctus		1	15
Cricotopus/Orthocladius	18	15	93
Diamesa			1
Dicrotendipes	2		14
Diplocladius			1
Diptera	4		
Glyptotendipes	1		5
Hydrobaenus	11	24	26
Mesosmittia	1		
Paraphaenocladius	7	9	3
Paratanytarsus	1	1	2
Pericoma		1	
Phaenopsectra		1	
Procladius	4		
Pseudosmittia	1	2	
Rheocricotopus		1	
Simulium			34
Smittia	7		
Stenochironomus			1
Tanytarsus	1	2	19
Thienemannimyia grp.	1	1	
Tipulidae		1	

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0418689], Station #3, Sample Date: 4/6/2004 12:00:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
Zavrelimyia	2		
EPHEMEROPTERA			
Acerpenna			1
Caenis latipennis	230	292	72
Hexagenia limbata	1		
Leptophlebia		2	2
Paraleptophlebia		3	
Stenacron	6	1	3
Stenonema femoratum		2	3
Stenonema terminatum	-99		
HEMIPTERA			
Trichocorixa	1		
LUMBRICINA			
Lumbricidae			1
ODONATA			
Enallagma	1	1	
Ischnura	2	1	
Libellula		1	
Progomphus obscurus	2	-99	
PLECOPTERA			
Perlesta		2	3
TRICHOPTERA			
Cheumatopsyche	1		
Cyrnellus fraternus	1		
Limnephilidae	1	2	
Triaenodes		1	
TUBIFICIDA			
Aulodrilus		1	
Enchytraeidae	16	19	2
Limnodrilus hoffmeisteri	3		1
Tubificidae	4		

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0418690], Station #4, Sample Date: 4/6/2004 3:00:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
AMPHIPODA			
Hyalella azteca	15	15	2
ARHYNCHOBDELLIDA			
Erpobdellidae		-99	
BRANCHIOBDELLIDA			
Branchiobdellida		2	
COLEOPTERA			
Dubiraphia	4	3	
Helichus lithophilus	1	8	
Peltodytes	1		
DECAPODA			
Orconectes virilis	1	-99	
DIPTERA			
Ablabesmyia	1		
Ceratopogoninae	4		2
Cnephia			1
Corynoneura	1		
Cricotopus bicinctus	9	12	32
Cricotopus/Orthocladius	16	16	100
Dicrotendipes	2		7
Glyptotendipes			2
Hydrobaenus	11	1	19
Labrundinia	2	5	
Nanocladius		1	1
Ormosia	1	1	
Paracladopelma	1		
Parametriocnemus			1
Paraphaenocladius	1	3	2
Paratanytarsus	7	20	13
Polypedilum convictum grp			1
Polypedilum fallax grp			3
Polypedilum halterale grp	2		
Polypedilum illinoense grp			1
Procladius	1		
Psychoda	1		
Rheocricotopus		2	
Rheotanytarsus		1	1

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0418690], Station #4, Sample Date: 4/6/2004 3:00:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
Simulium	2	19	
Tabanus	1	-99	
Tanytarsus	11	8	11
Thienemannimyia grp.	2	5	3
Zavrelimyia	1		
EPHEMEROPTERA			
Acerpenna		1	
Caenis latipennis	160	189	41
Stenacron	3	1	1
LIMNOPHILA			
Physella	1	1	
ODONATA			
Basiaeschna janata		1	
Enallagma	1		
Gomphus	2		
Ischnura	4	2	
Libellula	-99	1	
Nasiaeschna pentacantha		-99	
Progomphus obscurus	4		
PLECOPTERA			
Amphinemura	1	11	
Perlesta	1	25	4
RHYNCHOBDELLIDA			
Glossiphoniidae	1		
TRICHOPTERA			
Cheumatopsyche		1	2
Ironoquia		1	
Oecetis	1		
Ptilostomis		-99	
Triaenodes	1	6	
TUBIFICIDA			
Enchytraeidae	3	9	2
Limnodrilus hoffmeisteri	1		
Tubificidae	1		
VENEROIDEA			
Corbicula	-99		
Sphaeriidae	7		

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0418757], Station #1, Sample Date: 9/21/2004 9:45:00 AM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
AMPHIPODA			
Hyalella azteca			1
BRANCHIOBDELLIDA			
Branchiobdellida		1	
COLEOPTERA			
Dubiraphia	2	5	1
Helichus lithophilus		10	1
Hydroporus	1	2	
Macronychus glabratus			1
DECAPODA			
Cambarus diogenes		-99	
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia	34	18	6
Ceratopogoninae	1		
Chironomus	25		
Cladotanytarsus	2		1
Cricotopus/Orthocladius			6
Cryptochironomus	1		
Cryptotendipes	3		
Dicrotendipes			3
Endochironomus	1		1
Erioptera	1	1	
Forcipomyiinae			3
Glyptotendipes		1	
Hemerodromia		2	4
Labrundinia	1	11	4
Larsia			1
Lopescladius			1
Mesosmittia		1	
Nanocladius	1	1	
Nilotanypus			1
Paracladopelma	1		
Paralauterborniella	2	1	1
Paratanytarsus	3		
Paratendipes	1		
Phaenopsectra		1	

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0418757], Station #1, Sample Date: 9/21/2004 9:45:00 AM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
Polypedilum	1	1	1
Polypedilum convictum grp		2	1
Polypedilum halterale grp	1		
Polypedilum illinoense grp	58	44	10
Polypedilum scalaenum grp	6	2	1
Procladius	1		
Rheotanytarsus	4	12	58
Simulium		2	8
Stelechomyia			2
Stempellina	1		
Stenochironomus			9
Tanytarsus	20	19	56
Thienemanniella			12
Thienemannimyia grp.		1	
Tipula	2	5	
EPHEMEROPTERA			
Acentrella		2	2
Acerpenna		4	7
Baetis			17
Caenis hilaris	3	1	
Caenis latipennis	27	53	2
Callibaetis		1	
Cercobrachys	1		
Heptagenia		1	3
Heptageniidae		8	2
Hexagenia	3	2	
Isonychia			1
Leptophlebiidae	14	63	2
Paracloeodes	1	1	
Procloeon	1		1
Stenacron	10	17	6
Stenonema pulchellum	1	1	
Stenonema terminatum		1	1
Tricorythodes	4	13	1
HEMIPTERA			
Neoplea	1		
Rhagovelia		1	1
LIMNOPHILA			

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0418757], Station #1, Sample Date: 9/21/2004 9:45:00 AM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
Physella	1		
ODONATA			
Argia		2	
Boyeria		-99	
Gomphus	1	1	
Hetaerina		2	
Ischnura		2	
Progomphus obscurus	1	-99	
TRICHOPTERA			
Cheumatopsyche		2	10
Hydroptila			1
Nectopsyche	2	16	
VENEROIDEA			
Sphaeriidae		4	

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0418758], Station #4, Sample Date: 9/22/2004 8:45:00 AM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
AMPHIPODA			
Hyalella azteca	2	32	
COLEOPTERA			
Dubiraphia	8	5	1
Stenelmis		1	
DECAPODA			
Orconectes virilis	-99	-99	
DIPTERA			
Ablabesmyia	39	28	7
Anopheles		1	
Ceratopogoninae		1	
Chironomus	2		
Cladotanytarsus	24		9
Clinotanypus		1	
Corynoneura	1		
Cricotopus bicinctus		1	
Cricotopus/Orthocladius			2
Cryptochironomus	3		3
Cryptotendipes	6		7
Dicrotendipes	1		18
Ephydridae	5		
Forcipomyiinae	1		1
Glyptotendipes		8	11
Labrundinia	5	1	3
Nanocladius	16	16	12
Parachironomus		11	
Paracladopelma			1
Paralauterborniella	9		1
Paratanytarsus	5	3	1
Phaenopsectra		1	1
Polypedilum	2	2	4
Polypedilum convictum grp	1		
Polypedilum illinoense grp	30	18	5
Polypedilum scalaenum grp	4		9
Procladius	9	3	1
Rheotanytarsus	2	2	
Stempellinella	13		2

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0418758], Station #4, Sample Date: 9/22/2004 8:45:00 AM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
Stenochironomus			19
Tanytarsus	67	21	104
Thienemanniella			2
Thienemannimyia grp.	2	13	4
EPHEMEROPTERA			
Baetis	1		
Caenis hilaris	2	3	
Caenis latipennis	33	71	1
Callibaetis		2	
Cercobrachys	5		3
Heptageniidae	4		3
Hexagenia	10	-99	
Leptophlebiidae	5	67	6
Procloeon	8	2	12
Stenacron	2	20	9
Stenonema femoratum	1		
Stenonema terminatum	2		
Tricorythodes	1	2	
HEMIPTERA			
Belostoma		-99	
Neoplea		3	
MEGALOPTERA			
Sialis		-99	
ODONATA			
Argia		1	
Calopteryx	-99		
Enallagma		3	
Gomphus	2		
Ischnura		11	
Macromia		-99	
TRICHOPTERA			
Cernotina		1	
Nectopsyche		9	
Triaenodes		1	
TUBIFICIDA			
Tubificidae	1		1

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0418759], Station #3, Sample Date: 9/23/2004 8:45:00 AM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
"HYDRACARINA"			
Acarina	1	1	2
AMPHIPODA			
Hyalella azteca		16	2
BRANCHIOBDELLIDA			
Branchiobdellida	1	2	
COLEOPTERA			
Dubiraphia	1	2	
Helichus lithophilus	3	3	7
Hydroporus	1		
Stenelmis	1		
DECAPODA			
Orconectes virilis	-99	1	
DIPTERA			
Ablabesmyia	27	14	2
Anopheles		1	
Ceratopogoninae	1	2	
Chironomus	2	1	
Cladotanytarsus	7		1
Corynoneura	3		1
Cricotopus bicinctus			1
Cricotopus/Orthocladius			5
Cryptochironomus	1	1	
Cryptotendipes	1		
Endochironomus	1		1
Ephydridae	3		
Forcipomyiinae			12
Glyptotendipes	1	2	3
Harnischia	1		
Hemerodromia			10
Labrundinia	6	15	8
Nanocladius	13	11	4
Parachironomus		1	
Paracladopelma	1		1
Paralauterborniella	2	1	
Paratanytarsus		3	
Polypedilum			2

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0418759], Station #3, Sample Date: 9/23/2004 8:45:00 AM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
Polypedilum convictum grp		1	3
Polypedilum illinoense grp	14	8	33
Polypedilum scalaenum grp	2		1
Pseudochironomus			1
Rheocricotopus			1
Rheotanytarsus	8	16	22
Simulium	1	1	15
Stempellinella	15		3
Stenochironomus		1	2
Tanytarsus	52	21	33
Thienemanniella		1	1
Thienemannimyia grp.	1	17	33
Tribelos			1
EPHEMEROPTERA			
Acerpenna	5		
Baetis			11
Brachycercus	6		
Caenis hilaris		1	
Caenis latipennis	56	46	3
Caenis punctata		3	3
Heptagenia			6
Heptageniidae			3
Hexagenia limbata	5		
Leptophlebiidae	19	57	7
Paracloeodes	1		
Procloeon	14		1
Pseudocloeon		1	
Stenacron	8	20	4
Stenonema pulchellum			3
Stenonema terminatum	2		2
Tricorythodes	7	11	
HEMIPTERA			
Belostoma	-99	-99	
ODONATA			
Argia	1	7	
Boyeria		1	
Gomphus	2		
Hetaerina		2	

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0418759], Station #3, Sample Date: 9/23/2004 8:45:00 AM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
Ischnura		4	
Libellulidae		1	
TRICHOPTERA			
Cheumatopsyche	1	4	12
Nectopsyche	3	7	
TUBIFICIDA			
Tubificidae	1	3	3
VENEROIDEA			
Sphaeriidae		-99	

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0503060], Station #1a, Sample Date: 4/4/2005 12:30:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
AMPHIPODA			
Hyalella azteca		1	
COLEOPTERA			
Helichus basalis		1	1
Helichus lithophilus	2	2	1
Hydroporus		1	
Macronychus glabratus		1	
Stenelmis			2
DIPTERA			
Ablabesmyia	4	1	
Axarus	1		
Ceratopogoninae	1		3
Corynoneura	1	3	
Cricotopus bicinctus	1	7	6
Cricotopus/Orthocladius	20	51	114
Cryptochironomus	5	2	
Cryptotendipes	8		
Dicrotendipes	6		24
Diptera		1	1
Glyptotendipes			2
Hemerodromia	2		10
Hydrobaenus	4		6
Labrundinia	5	15	
Nanocladius	5	14	3
Paracladopelma	2		
Parakiefferiella	1		
Paralauterborniella	10		
Parametriocnemus			2
Paratanytarsus	18	33	5
Phaenopsectra	7	4	
Polypedilum convictum grp	4	5	8
Polypedilum fallax grp		1	1
Polypedilum halterale grp	1		
Polypedilum illinoense grp	17	33	15
Polypedilum scalaenum grp	2	1	4
Procladius	1		
Rheocricotopus			2

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0503060], Station #1a, Sample Date: 4/4/2005 12:30:00 PM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
Rheotanytarsus	10	113	40
Saetheria			2
Simulium		1	1
Stenochironomus		1	14
Tanytarsus	125	101	91
Thienemanniella		1	
Thienemannimyia grp.	2	27	7
Zavrelimyia	2	1	1
EPHEMEROPTERA			
Acerpenna	2	24	1
Baetisca lacustris			1
Caenis latipennis	7	12	3
Heptagenia		2	
Hexagenia limbata	1		
Leptophlebia	5	6	
Stenacron	8	6	
Stenonema terminatum	4	9	6
HEMIPTERA			
Trichocorixa			1
ODONATA			
Argia	-99		
Hetaerina		1	
Ischnura	1		
Progomphus obscurus	1		
PLECOPTERA			
Isoperla		1	
Perlidae		1	
TRICHOPTERA			
Cheumatopsyche	3	11	9
Hydropsyche			2
Hydroptila			1
Nectopsyche		1	
TUBIFICIDA			
Enchytraeidae		2	
Limnodrilus claparedianus	1		
Limnodrilus hoffmeisteri			1
Tubificidae		2	

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0503061], Station #1b, Sample Date: 4/4/2005 12:30:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
AMPHIPODA			
Hyalella azteca		1	
COLEOPTERA			
Dubiraphia	1	1	
Helichus lithophilus		3	
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia	4	2	1
Cladotanytarsus	3		
Corynoneura	1	2	
Cricotopus bicinctus	3	8	2
Cricotopus/Orthocladius	78	52	108
Cryptochironomus	5		
Cryptotendipes	8	1	
Dicrotendipes		2	5
Diptera	1		
Glyptotendipes			1
Gonomyia	1		
Hemerodromia			4
Hydrobaenus	4	2	
Labrundinia	1	2	
Larsia		2	
Nanocladius	7	2	1
Paracladopelma	4		
Parakiefferiella	1		
Paralauterborniella	14	1	
Paratanytarsus	6	18	3
Paratendipes	2		
Phaenopsectra		1	
Polypedilum convictum grp	2	7	8
Polypedilum fallax grp			4
Polypedilum halterale grp	2		
Polypedilum illinoense grp	10	28	11
Polypedilum scalaenum grp	9		1
Procladius	1		
Rheotanytarsus	9	79	38

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0503061], Station #1b, Sample Date: 4/4/2005 12:30:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
Simulium		3	
Stenochironomus			3
Tanytarsus	181	84	79
Thienemanniella			2
Thienemannimyia grp.	4	20	2
Zavrelimyia	2		
EPHEMEROPTERA			
Acerpenna	4	35	
Baetisca lacustris	2		
Caenis latipennis	13	7	
Heptagenia		5	
Heptageniidae		3	
Leptophlebia	1	8	
Stenacron	3	1	
Stenonema terminatum	1	8	
ODONATA			
Gomphus	3	1	
Macromia		-99	
Progomphus obscurus	-99	-99	
PLECOPTERA			
Perlesta	1	2	
TRICHOPTERA			
Cheumatopsyche	2	7	
Nectopsyche		1	
TUBIFICIDA			
Enchytraeidae	3	3	
Tubificidae	3	1	
VENEROIDEA			
Sphaeriidae		-99	

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0503062], Station #3, Sample Date: 4/4/2005 4:30:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
AMPHIPODA			
Hyalella azteca		2	
COLEOPTERA			
Dubiraphia	5	3	
Helichus lithophilus		1	
Macronychus glabratus		1	
DECAPODA			
Orconectes virilis	-99	2	
DIPTERA			
Ablabesmyia	16	2	
Cladotanytarsus	10		
Corynoneura	1		1
Cricotopus bicinctus	1	11	2
Cricotopus/Orthocladius	28	20	86
Cryptochironomus	6		
Cryptotendipes	1		
Dicrotendipes	2		29
Glyptotendipes		1	3
Hemerodromia			4
Hydrobaenus	9		
Labrundinia	3	7	1
Larsia		1	
Nanocladius	1	16	2
Paracladopelma		1	
Parakiefferiella			1
Paralauterborniella	1		
Paratanytarsus	10	38	4
Phaenopsectra	2	4	
Polypedilum convictum grp		2	5
Polypedilum illinoense grp	13	15	23
Polypedilum scalaenum grp	2		
Pseudochironomus			1
Rheotanytarsus	20	94	63
Saetheria	2		
Simulium	1		1
Stelechomyia			1
Stenochironomus		1	7

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0503062], Station #3, Sample Date: 4/4/2005 4:30:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
Tanytarsus	133	72	83
Thienemanniella			1
Thienemannimyia grp.	7	21	9
Tribelos			1
Zavrelimyia	2		
EPHEMEROPTERA			
Acerpenna	1	35	5
Caenis latipennis	3	38	2
Heptagenia	1		3
Hexagenia limbata	3	2	
Leptophlebia	-99	6	
Stenacron	7	8	1
Stenonema terminatum	7	2	1
ODONATA			
Argia		2	
Gomphus	-99	-99	
Hetaerina		-99	
Macromia		1	
TRICHOPTERA			
Cheumatopsyche		9	1
Cyrnellus fraternus			1
Hydroptila		1	
Nectopsyche	1	8	
Triaenodes		1	
TUBIFICIDA			
Limnodrilus hoffmeisteri		1	
Tubificidae	2	1	
VENEROIDEA			
Sphaeriidae	1	-99	

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0503063], Station #4, Sample Date: 4/5/2005 9:30:00 AM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
"HYDRACARINA"			
Acarina	7	1	
AMPHIPODA			
Hyalella azteca		10	
BRANCHIOBDELLIDA			
Branchiobdellida		1	
COLEOPTERA			
Dubiraphia	1	3	
Helichus lithophilus		2	
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia	8	1	
Ceratopogoninae		1	1
Chaoborus	2		
Chironomus	1		
Cladotanytarsus	36		
Corynoneura		2	
Cricotopus bicinctus	1	2	7
Cricotopus/Orthocladius	49	13	68
Cryptochironomus	3		1
Cryptotendipes	2		
Dicrotendipes	6		10
Dolichopodidae			1
Glyptotendipes	1		2
Harnischia	1		
Hemerodromia			1
Hydrobaenus	11		
Labrundinia		4	
Nanocladius	4	4	6
Nilothauma			1
Paracladopelma	1		
Paralauterborniella	9		
Paratanytarsus	5	37	13
Paratendipes	1		
Phaenopsectra			3
Polypedilum convictum grp		2	2

Aquid Invertebrate Database Bench Sheet Report

East Fk Medicine Ck [0503063], Station #4, Sample Date: 4/5/2005 9:30:00 AM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
Polypedilum halterale grp	9		
Polypedilum illinoense grp	8	23	4
Polypedilum scalaenum grp	18		2
Rheotanytarsus	6	125	42
Saetheria			1
Simulium		1	3
Stenochironomus			3
Tabanus	-99		
Tanytarsus	90	78	152
Thienemanniella		2	1
Thienemannimyia grp.		8	13
EPHEMEROPTERA			
Acerpenna		53	1
Caenis latipennis	6	30	3
Heptagenia	-99		
Hexagenia limbata	3		
Leptophlebia	-99	6	
Stenacron		2	7
Stenonema terminatum	-99		2
ODONATA			
Enallagma		2	
Progomphus obscurus	-99		
PLECOPTERA			
Perlidae		2	
TRICHOPTERA			
Cheumatopsyche		2	1
Nectopsyche		2	
TUBIFICIDA			
Enchytraeidae		1	
VENEROIDEA			
Sphaeriidae	-99		

Aquid Invertebrate Database Bench Sheet Report

Locust Ck [0418756], Station #1, Sample Date: 9/16/2004 1:45:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
"HYDRACARINA"			
Acarina	2	1	
AMPHIPODA			
Hyalella azteca	4	70	5
BRANCHIOBDELLIDA			
Branchiobdellida		1	
COLEOPTERA			
Dubiraphia	3	8	1
Helichus lithophilus		1	1
Hydroporus	1		
Scirtes		2	2
DECAPODA			
Orconectes virilis		1	
DIPTERA			
Ablabesmyia	17	12	15
Axarus	1		
Ceratopogoninae	14	1	
Chironomus	5		1
Cladotanytarsus	26		5
Corynoneura		1	2
Cricotopus/Orthocladius	1		
Cryptochironomus	10		1
Cryptotendipes	2		
Dicrotendipes	1	2	38
Diptera	2		2
Glyptotendipes		6	24
Harnischia	1		
Labrundinia	2	31	1
Nanocladius	1	1	
Parachironomus		1	
Paracladopelma	3		
Parakiefferiella			1
Paratanytarsus	12	21	9
Phaenopsectra		2	2
Polypedilum	1		1
Polypedilum convictum grp	1		
Polypedilum fallax grp			4

Aquid Invertebrate Database Bench Sheet Report

Locust Ck [0418756], Station #1, Sample Date: 9/16/2004 1:45:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
Polypedilum halterale grp	6		
Polypedilum illinoense grp	12	29	35
Polypedilum scalaenum grp	1		3
Procladius	3		1
Pseudochironomus			2
Rheotanytarsus	1	4	1
Stempellinella	10		
Stenochironomus			43
Tanytarsus	50	10	52
Thienemanniella			1
Thienemannimyia grp.	1	3	9
Tribelos	1		2
EPHEMEROPTERA			
Acerpenna			1
Baetis	1		4
Caenis latipennis	61	87	19
Callibaetis		1	
Hexagenia limbata	6		
Leptophlebiidae	2	19	3
Procloeon	3		1
Pseudocloeon	1		
Stenacron		4	4
HEMIPTERA			
Microvelia		1	
Neoplea		1	
Rheumatobates	1		
ODONATA			
Enallagma		11	
Gomphus	3		
Ischnura		5	-99
Libellulidae			1
TRICHOPTERA			
Cheumatopsyche			1
TUBIFICIDA			
Tubificidae	2	1	

Aquid Invertebrate Database Bench Sheet Report

Locust Ck [0503064], Station #1, Sample Date: 4/5/2005 12:40:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
AMPHIPODA			
Hyalella azteca	1	8	
BRANCHIOBDELLIDA			
Branchiobdellida		1	
COLEOPTERA			
Dubiraphia	2	1	
Helichus lithophilus			1
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia	12	1	
Cladotanytarsus	16		
Corynoneura			1
Cricotopus bicinctus	3	18	14
Cricotopus/Orthocladius	4	18	51
Cryptochironomus	1	4	2
Dicrotendipes	3	2	11
Glyptotendipes		3	3
Hemerodromia			1
Hydrobaenus	3	1	
Labrundinia	1	9	
Nanocladius		4	4
Ormosia	1		
Paracladopelma			1
Parametriocnemus			3
Paratanytarsus	27	145	33
Phaenopsectra	1	1	
Polypedilum	2		
Polypedilum convictum grp	1	2	11
Polypedilum halterale grp	60		1
Polypedilum illinoense grp	2	10	8
Polypedilum scalaenum grp	7		
Procladius	1		
Rheotanytarsus		52	28
Saetheria	6		2
Simulium			1
Stenochironomus			2

Aquid Invertebrate Database Bench Sheet Report

Locust Ck [0503064], Station #1, Sample Date: 4/5/2005 12:40:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
Stictochironomus	1		
Tanytarsus	126	104	76
Thienemannimyia grp.		28	12
Tipula		-99	
Zavrelimyia	2		
EPHEMEROPTERA			
Acerpenna			2
Caenis latipennis	14	29	4
Heptagenia	7	1	-99
Hexagenia limbata	2		
Leptophlebia		-99	
Stenacron		2	-99
MEGALOPTERA			
Sialis		-99	
ODONATA			
Argia		2	
Enallagma		4	
Progomphus obscurus	-99		
TRICHOPTERA			
Cheumatopsyche	1	4	12
Ironoquia		1	
TUBIFICIDA			
Enchytraeidae	1		
Limnodrilus hoffmeisteri	1		

Aquid Invertebrate Database Bench Sheet Report

West Locust Ck [0418761], Station #1a, Sample Date: 9/30/2004 9:45:00 AM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
"HYDRACARINA"			
Acarina	1	2	
AMPHIPODA			
Hyalella azteca	1	22	
COLEOPTERA			
Dubiraphia	3	13	1
Gyrinus		-99	
Helichus lithophilus	1	11	
Hydroporus	1	2	1
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia	57	8	1
Cladotanytarsus	1		2
Corynoneura		2	
Cricotopus bicinctus		1	
Cricotopus/Orthocladius			1
Cryptochironomus	15	1	5
Dicrotendipes	2		11
Endochironomus	1	1	
Glyptotendipes	6	15	1
Harnischia		1	
Kiefferulus	1		
Labrundinia	5	12	5
Nanocladius	1	5	2
Nilothauma			1
Parachironomus	3	4	5
Paracladopelma		1	
Paratanytarsus	7	9	
Phaenopsectra	1		
Polypedilum convictum grp		3	
Polypedilum illinoense grp	8	16	2
Polypedilum scalaenum grp	1	1	2
Procladius	4		
Pseudochironomus	1	1	1
Rheotanytarsus	4	41	119
Smittia			1

Aquid Invertebrate Database Bench Sheet Report

West Locust Ck [0418761], Station #1a, Sample Date: 9/30/2004 9:45:00 AM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
Stempellinella	9		4
Stenochironomus			11
Tanytarsus	103	46	45
Thienemannimyia grp.	16	15	20
Tribelos	5	4	1
EPHEMEROPTERA			
Acerpenna	3	3	3
Baetis			3
Caenis hilaris	1		
Caenis latipennis	85	63	4
Leptophlebiidae	4	26	
Procloeon			3
Stenacron	5	7	4
Stenonema femoratum	2		
Stenonema terminatum	1		
LIMNOPHILA			
Ancylidae		1	
Lymnaeidae		1	
Physella	2		
MEGALOPTERA			
Sialis		-99	
ODONATA			
Argia	1	1	
Enallagma		6	
Gomphus		-99	
Nasiaeschna pentacantha		-99	
TRICHOPTERA			
Cheumatopsyche	2	4	32
Hydropsyche			1
Oecetis	1	3	1
Polycentropodidae		1	1
Triaenodes		3	
TRICLADIDA			
Planariidae		1	
TUBIFICIDA			
Tubificidae	1	4	
VENEROIDEA			
Sphaeriidae	4	-99	

Aquid Invertebrate Database Bench Sheet Report

West Locust Ck [0418762], Station #1b, Sample Date: 9/30/2004 9:45:00 AM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
AMPHIPODA			
Hyalella azteca		22	
ARHYNCHOBDELLIDA			
Erpobdellidae		1	
COLEOPTERA			
Dubiraphia	4	11	
Helichus lithophilus	2	7	3
Scirtes		1	
DIPTERA			
Ablabesmyia	42	11	1
Ceratopogoninae	2	1	
Chironomus	4		
Cladotanytarsus	1		1
Corynoneura		1	
Cryptochironomus	7	1	1
Dicrotendipes			7
Endochironomus	1	1	1
Glyptotendipes		4	5
Labrundinia	6	5	6
Lipiniella	20		
Nanocladius		2	
Parachironomus	1	4	5
Paratanytarsus	3	7	
Phaenopsectra		1	
Polypedilum	1		
Polypedilum convictum grp		1	
Polypedilum halterale grp	1		
Polypedilum illinoense grp	5	6	4
Pseudochironomus	2		6
Rheotanytarsus		234	125
Simulium			1
Stempellinella	10	1	1
Stenochironomus			20
Tanytarsus	93	30	18
Thienemanniella		1	
Thienemannimyia grp.	3	37	20
Tribelos	4	2	

Aquid Invertebrate Database Bench Sheet Report

West Locust Ck [0418762], Station #1b, Sample Date: 9/30/2004 9:45:00 AM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
EPHEMEROPTERA			
Acerpenna	1	4	8
Baetis		1	2
Caenis latipennis	82	56	1
Leptophlebiidae	2	15	2
Stenacron	3	3	3
LIMNOPHILA			
Physella	4	1	1
LUMBRICULIDA			
Lumbriculidae		1	
ODONATA			
Argia		1	
Boyeria		-99	
Enallagma		3	
Gomphus		-99	
RHYNCHOBDELLIDA			
Glossiphoniidae		-99	
TRICHOPTERA			
Cheumatopsyche	1	36	19
Hydroptila			1
Limnephilidae		1	2
Nectopsyche	3	2	1
TRICLADIDA			
Planariidae		1	
TUBIFICIDA			
Branchiura sowerbyi	-99	3	
Enchytraeidae	1		
Tubificidae	2	2	1
VENEROIDEA			
Sphaeriidae	14	6	-99

Aquid Invertebrate Database Bench Sheet Report

West Locust Ck [0503065], Station #1, Sample Date: 4/5/2005 4:15:00 PM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	1		1
AMPHIPODA			
Hyalella azteca		14	
COLEOPTERA			
Dubiraphia		7	1
Helichus lithophilus			1
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia	6	4	
Ceratopogoninae	1	1	
Chironomus	1		
Cladotanytarsus	12	1	
Corynoneura		1	
Cricotopus bicinctus	2	4	1
Cricotopus/Orthocladius	25	13	43
Cryptochironomus	13	3	1
Cryptotendipes	1		
Glyptotendipes	1		1
Hydrobaenus	2		
Labrundinia		1	
Lipiniella	1		
Nanocladius	1	1	2
Paracladopelma	2		
Paralauterborniella	3	1	
Paraphaenocladius		1	
Paratanytarsus	30	34	4
Paratendipes	1		
Phaenopsectra	3	3	2
Polypedilum convictum grp	1		32
Polypedilum fallax grp			4
Polypedilum halterale grp	9		
Polypedilum illinoense grp	10	15	13
Polypedilum scalaenum grp	10		
Procladius	1		
Pseudochironomus	1		

Aquid Invertebrate Database Bench Sheet Report

West Locust Ck [0503065], Station #1, Sample Date: 4/5/2005 4:15:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
Rheotanytarsus	15	62	56
Saetheria	1		
Simulium	2	3	23
Stenochironomus	1		
Tanytarsus	112	95	47
Thienemannimyia grp.	8	19	9
Tribelos	1		
Zavrelimyia		1	
EPHEMEROPTERA			
Acerpenna	2	14	10
Caenis latipennis	53	43	6
Heptagenia			1
Hexagenia limbata	5		
Leptophlebia	1	4	
Stenacron	2	4	2
Stenonema femoratum	1		-99
Stenonema terminatum		-99	
LIMNOPHILA			
Physella		-99	
ODONATA			
Argia		1	
Enallagma		2	
Macromia		1	
Nasiaeschna pentacantha		1	
Progomphus obscurus	1		
PLECOPTERA			
Perlidae			1
TRICHOPTERA			
Cheumatopsyche	6	4	4
TUBIFICIDA			
Branchiura sowerbyi	1		
Limnodrilus hoffmeisteri	2		
Tubificidae	2		
VENEROIDEA			
Sphaeriidae	1	-99	

Aquid Invertebrate Database Bench Sheet Report

Spring Ck A [0418686], Station #1, Sample Date: 4/2/2004 12:30:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
"HYDRACARINA"			
Acarina	2		
AMPHIPODA			
Hyalella azteca	1	13	
COLEOPTERA			
Agabus		1	
Dubiraphia	1		
Helichus lithophilus	2	2	
Hydroporus	3		
Paracymus	1	1	
Peltodytes	4		
Stenelmis	1		
Tropisternus		1	
DECAPODA			
Orconectes virilis		1	
Palaemonetes kadiakensis		-99	
DIPTERA			
Ablabesmyia	2	1	
Ceratopogoninae	3	1	

Aquid Invertebrate Database Bench Sheet Report

Spring Ck A [0418686], Station #1, Sample Date: 4/2/2004 12:30:00 PM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
Chaoborus	1		
Cladopelma	1		
Cladotanytarsus	13		2
Cnephia		1	
Corynoneura	1		
Cricotopus bicinctus	3	6	5
Cricotopus/Orthocladius	2	27	35
Cryptochironomus	1		
Dicrotendipes	5	2	16
Diptera		1	5
Glyptotendipes	1	2	3
Gonomyia	1		1
Hydrobaenus	3	16	11
Larsia		1	
Nanocladius		1	
Ormosia	12	1	
Paralauterborniella	1		
Paraphaenocladius	2	3	
Paratanytarsus		3	2
Pericoma	6	3	
Phaenopsectra	1		
Polypedilum halterale grp	2		
Polypedilum illinoense grp	1		
Polypedilum scalaenum grp	1		
Psychoda	1		
Rheotanytarsus			1
Silvius	1		
Stictochironomus	1	1	
Stratiomys	1		
Tanytarsus	12	6	6
Thienemannimyia grp.		2	1
Zavrelimyia		1	
EPHEMEROPTERA			
Acentrella			1
Caenis latipennis	124	163	35
Centroptilum	1	3	
Heptagenia			1
Hexagenia limbata	1		

Aquid Invertebrate Database Bench Sheet Report

Spring Ck A [0418686], Station #1, Sample Date: 4/2/2004 12:30:00 PM			
NF = Nonflow, RM = Rootmat, SG = Woody Debris			
A value of -99 indicates that the species was found, but the exact number of species was not determined.			
ORDER: TAXA	**NF**	**RM**	**SG**
Leptophlebia		2	
Stenonema femoratum	1	1	
HEMIPTERA			
Corixidae	14		
ODONATA			
Boyeria		1	
Enallagma		3	
Libellula	2	-99	
Macromia	1		
Progomphus obscurus	5		
PLECOPTERA			
Amphinemura		1	
Perlidae		19	10
TRICHOPTERA			
Nectopsyche		1	
Ptilostomis		-99	
TUBIFICIDA			
Aulodrilus	4		
Enchytraeidae	10	7	4
Limnodrilus hoffmeisteri	1	1	
Tubificidae	5	6	
VENEROIDEA			
Sphaeriidae	7		